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Section of Neurology

President—ANTHONY FEILING, M.D.

CASES SHOWN AT THE WEST END HOSPITAL FOR NERVOUS DISEASES, LONDON, W. 1, NOVEMBER 25, 1937

[*Continued*]

Essential Hypertension Treated by Division of the Splanchnic Nerves.—T. ROWLAND HILL, M.D.

F. R., female, aged 50 years.

Three years ago the patient began to feel dizzy and weak. She was said to have had a systolic blood-pressure of 186 mm. Hg when these symptoms occurred. Twelve months ago symptoms grew more severe, with giddiness, palpitation, ringing in the ears, and bursting headaches. The systolic blood-pressure was then 200 mm. Hg. Five months ago, on admission to hospital, the blood-pressure was 272/150. Investigations of renal function showed this to be normal.

There was no evidence of arteriosclerosis present. Some climacteric symptoms, such as hot flushes, were complained of. Throbbing headaches, especially upon straining, were severe. Rest in bed and vasodilator treatment had little effect.

Operation (Mr. G. C. Knight).—August 1937: All three splanchnic nerves and the thoracic sympathetic chain on the right side, and the greater and lesser splanchnic nerves on the other side, were divided in two stages with three weeks' interval.

Average blood-pressure: After the first stage 165/120; after the second stage, 150/100.

Condition now (five months after operation): Subjectively the patient feels much better. The throbbing bursting headaches have disappeared. Blood-pressure: 164/110 on lying down; 155/110 on standing up.

Discussion.—Dr. DENNY-BROWN asked whether this patient had had faintness on suddenly sitting up from the lying posture.

Dr. ROWLAND HILL said that no complaint of this had been made, but the blood-pressure was 10 mm. higher when the patient was lying down than when she was standing up.

The PRESIDENT said Dr. Hill had suggested that the climacteric might be a factor in this case. If so, he questioned whether the case could correctly be described as "essential hypertension". There were many women who, at the menopause, suffered from hypertension, but it might not last longer than a few months or a year, and afterwards the blood-pressure came down. In a patient of this age one would need to be cautious in recommending an operation of such severity, although in this instance it had been successful. Cases of the kind had been benefited by treatment with ovarian hormone.

Dr. HILL (in reply) said that this patient's blood-pressure had increased so rapidly that it seemed to him that the risk of something serious happening in the near future was great, and therefore, after preliminary medical treatment, the operation had been carried out.

Pseudopapillœdema.—T. ROWLAND HILL, M.D.

G. C., male, aged 12.

Six months ago some impairment of vision was noticed. Hypermetropic error of refraction was present (right eye 7; left eye 2·5). There was an appearance of definite papillœdema—bilateral, and with about 1·5D of swelling.

FIG. 1.—Lateral ventriculogram showing absence of any enlargement or distortion.

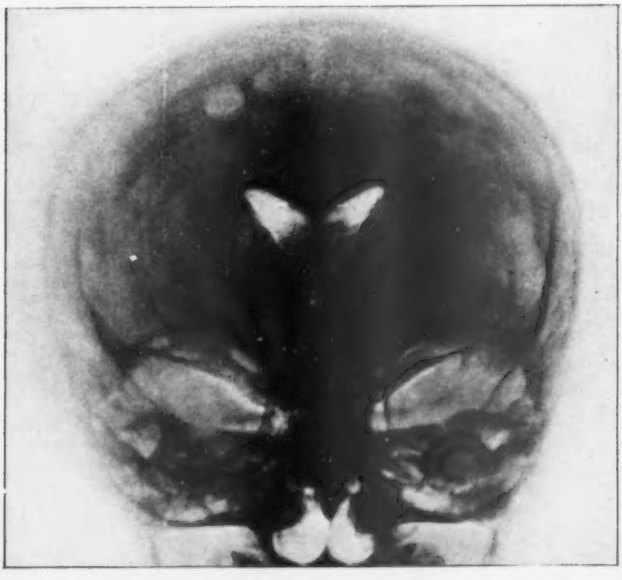

FIG. 2.—Antero-posterior ventriculogram showing undilated and undistorted ventricles.

Neurological examination revealed no abnormalities, except that all tendon reflexes were sluggish. A skiagram of the skull was normal.

Cerebrospinal fluid (lumbar puncture): Pressure 110 mm. Hg; cells 2. Total protein 0·015%; globulin, no excess. Lange curve 0000000000. Wassermann reaction negative in blood and fluid.

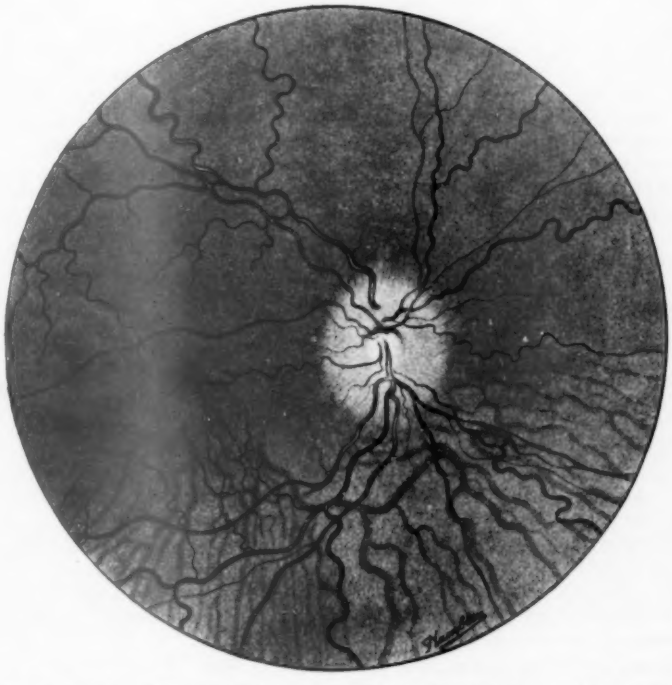

FIG. 3.—Fundus of the eye showing close simulation of papillœdema. A translucent gelatinous mass in front of the disc appears to be the cause.

Six weeks ago ventriculography was performed. There was no rise in intraventricular fluid pressure and, radiographically, the ventricular system was normal (figs. 1 and 2).

During the last six months the appearance of the discs—simulating papillœdema—has remained unaltered (fig. 3). Vision, $\frac{6}{6}$ in each eye. Fields normal. Blind spots not enlarged. No symptoms of raised intracranial tension have been, or are, present.

Cerebral Glioma treated with Deep X-rays.—A. ORLEY, M.D.

The patient, aged 34, complained of partial loss of vision, slight occipital headache, stiffness of left thigh, and attacks of giddiness. The illness began eighteen months ago, with a sudden attack of weakness, relative loss of vision in the left eye, paralysis

of the left arm and leg, and vomiting. The paralysis soon subsided, but the patient is still suffering from frequent attacks of giddiness, weakness, and defective vision. The cerebrospinal fluid was normal. Examination of the eyes revealed a left temporal hemianopia. The edges of the discs appeared striated but there was no definite swelling. Radiographic examination of the skull showed deepened convolutional impressions in the right temporo-parietal region. A right occipital tumour was diagnosed, and a year ago a right occipital decompression was carried out.

At the operation the dura was found to be tense and the bone underneath œdematous. No tumour could be felt immediately below the cortex. It was thought that the tumour was probably a deep spongioblastoma and the bone-flap was replaced. The patient has had an intensive course of deep X-ray therapy and the condition has remained stationary during the last year. The total dose has been approximately 10,000 r units on the skin from a number of fields on the scalp. We estimate that the tumour dose must have been at least 3,000 r units. The scalp has stood the heavy X-ray doses very well. American workers maintain that an impression can be made on cerebral gliomas only by very intensive doses such as we have given in this case.

The tumour is probably an astrocytoma—not a spongioblastoma as originally supposed, as spongioblastomas usually follow a rapidly fatal course in spite of X-ray treatment. However, the evolution of the growth can only be delayed for some time; no cures have, so far, been reported from treatment with deep X-rays in cases of cerebral glioma.

Brown-Séquard Syndrome at C 2 Level due to Vascular Lesion of Cord.—J. W. A. TURNER, M.B.

Male, aged 33.

History.—One morning five and a half years ago the patient woke up with intense giddiness, objects rotating in a clockwise direction. This lasted about a minute. There was no nausea or vomiting.

Two weeks later there was a sudden sensation of pins and needles down the left side of the body and in course of ten minutes great weakness of left arm and leg developed. During the next twelve hours the patient had headache and vomiting, and the weakness of the left arm and leg became worse. During the next two years power gradually came back in the paralysed arm and leg.

Two years ago he had some difficulty in writing with his right hand.

Nine months ago he had some weakness in raising his right arm up and down. There were never any pains or paræsthesiæ in limbs or face.

On examination.—The left pupil is smaller than the right. Diminution to pin-prick over left trigeminal distribution; the most marked in first division. Motor power is slightly reduced in left arm and leg; no weakness found on the right. Reflexes increased; absent abdominals and extensor plantar on the left, normal on the right.

Sensation: Anæsthesia and analgesia over left C 2 distribution and pin-prick diminished over left C 3. Diminution to pin-prick and temperature over right side of body below C 4.

Position, vibration, stereognosis, and two-point discrimination reduced on the left arm and leg, normal on the right.

Lumbar puncture: No evidence of block. Cerebrospinal fluid normal; Wassermann reaction normal.

Discussion.—Dr. DENNY-BROWN said that in view of the fact that sudden vascular accidents in the brain-stem occurred from hæmorrhages from telangiectasis, such an event might provide a basis for the disturbance in the cervical cord in this case.

Dr. TURNER thought it possible that there might have been bleeding into an angioma of the cord. The cerebrospinal fluid was examined ten days later and was declared to be normal.

Familial Tremor.—P. BUCKLEY, M.B.

W. W., male, aged 62.

Family history.—Father's hands very shaky. Brother shaky for many years; his youngest child shakes in both hands.

Present illness.—His hands have "always" been shaky; at the age of 13 he lost a job as a clerk on this account. Only in the last five years has the tremor been really troublesome; in the last two years has involved his head and legs. There is no slowness or stiffness, the tremor is increased by use of the hands and by excitement.

On examination.—Slow coarse tremor of lightly closed eyelids; continuous fine rapid tremor of the head. Tremor of the outstretched hands, of moderate amplitude, and of Parkinsonian rhythm, but about twice as fast. Slight rhythmical tremor of the legs in movement.

No rigidity. Central nervous system otherwise normal.

Discussion.—Dr. MACDONALD CRITCHLEY asked whether the patient belonged to a large family. Minor had stressed two extraneural peculiarities in families with essential tremor, namely longevity and fecundity.

Dr. BUCKLEY replied that the man had six brothers.

Dr. DENNY-BROWN said that familial tremor was usually a fairly stationary condition, but in this case it had progressed a good deal during recent years, so much in fact that the patient had lost an appointment because of it. Not only had it spread to involve the neck and other musculature, but it had increased in amplitude and in intensity. Did Dr. Critchley think that this was a natural progress in familial tremor?

Dr. CRITCHLEY said he thought it was due to the nature of the complaint. Familial tremor remained as a rule comparatively stationary for many years, but in later life took a turn for the worse, and might assume the characters of an "intention" tremor. It sometimes happened that other members of the family were afflicted with some form of delayed cerebellar atrophy, and it seemed in such cases as though the familial tremor was a *forme fruste* of a major degenerative disorder.

Cerebroretinal Degeneration of Late Infantile Type.—C. WORSTER-DROUGHT, M.D., and ARNOLD SORSBY, F.R.C.S.

P. P., aged 4½, was always well until early in 1937 except for backwardness in talking. About April it was noticed that his right leg was weak, and he would not stand alone. Two months ago, the left leg and left arm also became weak and he was unable to walk or to use his arms normally. His parents (non-Jewish) state that he is more drowsy and listless than previously. He is an only child; full term delivery with forceps, but no evidence of birth injury. His paternal grandmother and maternal grandfather were first cousins.

Physical examination.—Pupils dilated; equal; react normally. Fundi show pale optic discs with macular lesions of atrophic type; little pigmentary disturbance. The periphery of the fundus is albinotic in type and what little pigment is present is finely granulated and suggests considerable retinal atrophy. Other cranial nerves normal but speech somewhat indistinct and with vocabulary limited. Sensation apparently normal. Arm movements full, but weak. Right arm-jerks all brisker

than left. The child is unable to walk alone but walks with assistance ; shows tremors of both arms and legs when agitated. Knee- and ankle-jerks present, right greater than left ; no ankle clonus. Plantar reflexes : Right extensor, left indefinite. Sphincters incontinent. Other systems normal. Cerebrospinal fluid normal in all respects and blood Wassermann reaction negative.

Mentally, the child is backward, as judged from his general behaviour. He is able to use only one or two words and could not build a tower of wooden bricks more successfully than a child of 18 months of age.

Commentary.—Bielschowsky has described a type of late infantile amaurotic idiocy, forming a group intermediate between Tay-Sachs disease and Batten-Mayou disease. The affection is said to begin in the fourth year and the ocular changes consist in optic atrophy without a definite macular lesion. Histologically the appearances are somewhat similar to those seen in cases of the Tay-Sachs and Batten-Mayou types. That Tay-Sachs disease, however, may set in relatively late is suggested by the case reported by Greenfield and Nevin, in which the affection appeared at the age of 2 years, while cases of the Batten-Mayou type have been reported as occurring in the second and third year (Torrance, Vogt and Batten). Those who regard Tay-Sachs disease and Batten-Mayou disease as one entity see a connecting link in these intermediate cases. In view of the rarity of these atypical cases and the doubtful nature of at least some of them, this contention cannot be accepted as proved. There is, moreover, much evidence, both clinical and pathological, that Tay-Sachs disease and Batten-Mayou disease are not at all allied.

Combined Degeneration of the Cord with Polycythæmia.—C. WORSTER-DROUGHT, M.D.

Mrs. B. was first seen in 1933 at the age of 50. She complained of unsteadiness in walking and numbness and tingling in both hands and feet. The onset had occurred a year previously (five years ago) with numbness in the feet only. Unsteadiness in walking gradually developed and numbness and tingling appeared later in both hands. On examination, she showed normal cranial nerves, absent knee- and ankle-jerks, and an ataxic gait with Rombergism. The right plantar reflex was flexor and the left indefinite. The abdominal reflexes were absent, and vibration sense was diminished in the legs.

A blood-count showed R.B.C. 6,800,000 ; Hb. 124% ; C.I. 0·9. The cerebrospinal fluid showed no abnormality and there was no definite achlorhydria.

She was seen again in 1935. The gait was more ataxic but the other symptoms and signs remained unaltered. A blood-count showed R.B.C. 6,250,000 ; Hb. 120%, C.I. 0·96 ; W.B.C. 12,000.

Present condition.—Cranial nerves normal ; paræsthesia of both hands and legs with cramp-like sensations in the left leg. Cutaneous sensation to cotton-wool is diminished at the extremities. Postural sense is lost in the feet and in the right hand, and vibration sense is absent over both legs and in the right arm ; stereognostic sense is also poor in the right hand. The arms and legs show a full range of movement with fair power ; there is slight œdema of both legs. The right supinator jerk is brisker than the left ; the biceps and triceps jerks cannot be elicited, and the knee- and ankle-jerks are absent. There is no wasting. The abdominal reflexes are absent and the right plantar reflex is flexor, the left being somewhat indefinite. There is slight œdema of both legs. Ataxia is pronounced ; the patient can walk only with the aid of two supporters. Co-ordination of the arms is also defective.

Heart normal ; pulse-rate 76. Blood-pressure 160/100 ; liver and spleen not felt. Blood-count : R.B.C. 5,370,000 ; Hb. 88% ; C.I. 0·82 ; W.B.C. 10,500.

Differential count normal. No tendency to megalocytosis or poikilocytosis and no nucleated or basophil forms. Cerebrospinal fluid : 1 small lymphocyte per c.mm. ; total protein 0·025% ; no excess of globulin. Wassermann, Kahn, and Lange reactions negative. Fractional gastric analysis : No free hydrochloric acid in resting gastric juice but excess from three-quarters of an hour to two hours after test meal. Largest rise, 0·327% free hydrochloric acid at one hour. At two and a half hours the gastric juice shows only 0·073% free hydrochloric acid.

Commentary.—This is a most unusual case in that symptoms resembling those of subacute combined degeneration of the cord are seen in association not with anæmia, but with polycythæmia. Most of us are familiar with cases of true subacute combined degeneration in which there is no anæmia or in which anæmia develops at a later stage. This case has now been under observation for four years, and it is seen that the polycythæmia is gradually decreasing. At the same time, however, there is no constant achlorhydria.

At the present stage it is not suggested that the neurological condition in this patient is identical with that of true subacute combined degeneration, but it will be interesting to see what happens to the blood picture in the future. The symptoms and signs resemble those of true subacute combined degeneration in the paræsthesia, numbness, loss of sensation of different types, absent knee- and ankle-jerks and ataxia. The muscles are well developed, with fairly normal tone and with full range of movement and moderate power. Further, the electrical reactions are normal. Consequently, spinal cord lesions are more probable than a peripheral neuritis. The condition has been steadily progressive.

Neither spleen nor liver is enlarged.

Discussion.—Dr. F. PARKES WEBER said that this was a case of Gaisböck's polycythæmia hypertonica, which was different from the polycythæmia of the Vaquez type, sometimes associated with gross thrombosis. In Gaisböck's polycythæmia there was rather high blood-pressure, almost always without obvious splenomegaly.

Dr. E. A. CARMICHAEL said it was unfortunate that the term "subacute combined degeneration" was not limited to the condition in which there were nervous symptoms associated with a megalocytic anæmia ; this syndrome had a definite pathology, and on that account the term should be limited to this condition. In the cases with other types of blood disease it might be preferable simply to report them as "cases with nervous manifestations" and wait for post-mortem evidence as to the site and character of the lesion.

Professor P. C. CLOAKE said that he had seen cerebral thrombosis in polycythæmia hypertonica. The spleen was not enlarged, and there was no splenomegaly clinically.

Dr. CRITCHLEY said that this should not be reported as a case of subacute combined degeneration, as there was hydrochloric acid in abundance. He thought it was polycythæmia with a vascular lesion of the cord or with a peripheral neuritis.

Dr. H. G. GARLAND said he also thought that the case was not one of subacute combined degeneration ; there was no evidence of any lesion of the cord.

Dr. WORSTER-DROUGHT (in reply) said that he had not previously seen or heard of such a condition in association with polycythæmia. The ataxia was more profound than in the ordinary case of subacute combined degeneration of the cord.

Clinical Section

President—B. T. PARSONS-SMITH, M.D.

[*December* 10, 1937]

Aneurysm of the Popliteal Artery, Treated and Investigated by a New Method: Further Report on Case previously shown.[1]—D. C. L. FITZWILLIAMS, C.M.G., F.R.C.S.

W. C., male, aged 53. This patient was shown at the meeting held on October 8.

After his admission to hospital we attempted to open up the collateral circulation by a pyramidal bag of shot, which he held on the femoral artery for some hours a day for about three weeks. During this time the aneurysm grew a little larger but the bruising and dusky appearance of the skin diminished.

Operation (26.10.37).—An incision was made in the line of the artery in the middle of the thigh. Hunter's canal was exposed, and the artery was ligated as it passed through the opening in the adductor magnus. The parts were thickened and fibrosed by the tissues round the aneurysm.

Another incision was made lower down and the popliteal artery was ligated. This was a very difficult matter as the parts were all firmly matted together and there was no pulsation to guide one. There was a fear of including the vein, or even the internal popliteal nerve, in the ligature. It would have been easier to have dealt with the popliteal artery first, as the pulsation would have been a help.

A portable X-ray apparatus was then fixed up and a needle inserted into the artery just below the upper ligature; uroselectan was injected from a large syringe while two photographs were taken—one antero-posterior and the other lateral (figs. 1 and 2). Unfortunately some uroselectan leaked into the wound and we did not think of wiping it out; this rather obscures the upper part of the instructive pictures which were obtained. The collateral circulation was shown to be very free, and the ligature was obviously situated above the origin of the anastomatica magna. It was so free indeed that blood spurted forcibly from the needle and it was thought advisable to place another ligature below the origin of this vessel. The pictures show the arteries and the sac of the aneurysm very well, although it is impossible to say

[1] *Proceedings*, 1937, **31**, 9 (Clin. Sect., 1).

if it is abnormal or not, as the normal circulation, as shown by this method, had never been seen by me before.

The after-history has been uneventful. There was little pain ; the aneurysm became hard, and has gradually shrunk till now very little can be felt, and the limb appears normal. Power to use the leg has returned, and the patient can walk quite well.

A piece of catgut was discharged from the upper wound. The wound is still discharging, so I expect that the other ligature will eventually come away.

I have never before seen an aneurysm shown by this method, which I think should prove of the greatest value to the surgeon and could quite easily be carried out previous to operation. Lipiodol was suggested as the medium to use, but it was feared that, being oily, it might cause a lung infarct.

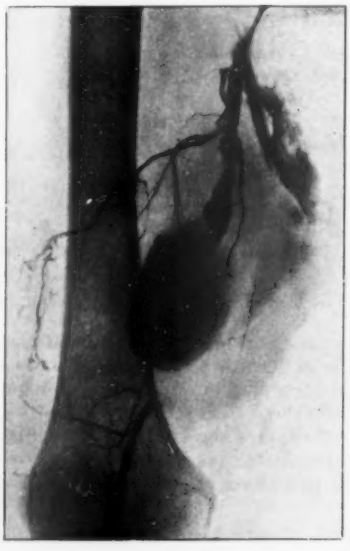

FIG. 1.

FIG. 2.

Mr. Fitzwilliams' case. Ligature already applied both above and below aneurysm. Fig. 1 : Anterior view. Note the free collateral circulation and disease of the vessel wall above the aneurysm. Fig. 2. : Lateral view.

POSTSCRIPT (13.12.37).—The importance of this line of investigation previous to operative procedure has become still more evident to me, for Professor Pannett informed me that he also had a case of popliteal aneurysm under his charge. I asked him to investigate it by the same method so that we could compare the two photographs of the patients.

He occluded the femoral artery by pressure on the pubic bone, injected uroselectan, and took two photographs. He then applied a ligature proximal to the aneurysm but none beyond it, as the lower part of the popliteal artery was lost in a thick mass of tissue.

His pictures show a large aneurysm with thick walls and a comparatively small cavity. The pulsation of the sac was very feeble. The collateral circulation appeared to be very poor, and indeed was scarcely to be seen in the photographs (figs. 3 and 4).

The day following the ligature there were already signs that gangrene of the toes was about to set in. Two days later the leg was dead half-way up the calf.

Both photographs show a point which used to be stressed by the older surgeons, namely that the formation of an aneurysmal sac is only a part of the general disease of the vessel wall, a point in favour of the Hunterian ligature at a distance, where

FIG. 3.

FIG. 4.

Professor Pannett's case. Fig. 3: Anterior view. Fig. 4: Lateral view. Collateral circulation very poor. Both photographs taken before ligature. Note extensive disease in the artery both above and below the aneurysm.

the wall is more healthy. Several irregularities and bulgings can be seen in the artery of my patient, while the artery in Professor Pannett's case, both above and below the aneurysm, looks as if it were a large and sacculated varicose vein.

The lesson to be drawn from these two cases is that information as to the condition of the collateral circulation should not be disregarded, and that when the circulation is found to be poor, operation should be delayed until measures have been taken to establish it. A second photograph will show if this has been accomplished.

Carcinomatous Mastitis.—D. C. L. FITZWILLIAMS, C.M.G., F.R.C.S.

A. J., female, aged 36.

History.—About ten weeks ago she noticed the left breast was stiff and swollen; there was no pain. This condition seemed to progress, till six weeks ago, when a slight redness appeared; this, she thinks, varied at times. At the same time she began to have recurrent pain in the breast, which later on became stabbing.

Previous history.—She had an operation (for a four months' tubal pregnancy) three years ago.

On examination.—The left breast has a slight blush over it, seems larger, fuller and more prominent than the right, and the nipple stands at a higher level. The nipple appears to protrude further on the right side, but is stiff and fixed and the skin all over the areola is bound down. The skin all over the breast is thickened, brawny and cannot be pinched up. On handling the breast no real lump can be felt, but the whole organ is hard and appears to be entirely occupied by a growth, it is slightly tender and pits on pressure. There are no glands to be felt in the axilla.

Two Cases of Inhaled Foreign Body.—N. M. JACOBY, M.R.C.P. (for R. W. B. ELLIS, M.D.).

(I) R. D., a boy, aged 5, an only child. Pneumonia and pleurisy when aged 2½ (affected side unknown). Had uncomplicated rubella and pertussis between ages of 1 and 2 years. Eight weeks ago developed a cough, which continued for two weeks, when he was brought to Guy's Hospital. Temperature 101° F. Slight heart shift to right. Dullness at right base, with absent breath and voice sounds over this area. Clinical diagnosis of collapse at right base confirmed by skiagram.

W.B.C. 22,000 (Polys. 59%; eosinos. 6%; basos. 1%; lymphos. 30%; hyals. 4%).

Mantoux test: Negative 1 : 10,000 and 1 : 1,000.

24.10.37 Bronchoscopy (Mr. R. C. Brock): "In lower right bronchus is a ragged friable polypoid mass, almost completely filling lumen, springing from postero-lateral wall. Piece removed for section."

Biopsy report (Professor G. W. de P. Nicholson): "Non-tuberculous ulceration. Contains a few loose hyperplastic epithelial cells, which in an adult I would certainly call malignant."

25.10.37 to 12.11.37: Five X-ray examinations showed opacity at right base to be increasing in size and excursion of diaphragm to be diminishing.

15.11.37: Clinical condition suggested pus in right chest. Needling produced thick pus in one small area with needle inserted deeply (probably from pulmonary abscess and not from pleura).

18.11.37 Bronchoscopy (Mr. R. C. Brock): "Granulomatous mass now disappeared. Piece of nut about size of silver threepenny bit seen in right bronchus. Removed and found to be piece of Brazil-nut quite intact. 15 c.c. of thick pus sucked out from abscess beyond."

Following removal of the foreign body, the clinical condition was much improved, and the temperature fell. The physical signs at the right base have remained practically unchanged.

(After removal of the nut, the parents remembered the child having been given a packet of nuts and raisins previous to the onset of symptoms, but recalled no history to suggest inhalation of a foreign body.)

(II) A boy aged 4. In May 1937, whilst eating peanuts, he had a severe "choking attack and was brought to hospital. Skiagrams of the chest were normal.

There was no pyrexia. It was considered unlikely that he had inhaled a nut. He was discharged after ten days' observation, and remained well until October 29, when he became pyrexial, with cough and abdominal pain. On admission to Guy's Hospital on October 30 : Temperature 103° F. ; pulse 140 ; respirations 45. Diminished movement of left chest ; Impaired percussion note on left and voice sounds much diminished over this area. X-ray examination showed left diaphragm moving poorly, opacity at left base, and some falling of left ribs.

2.11.37 : Temperature down to 101° F. Clinical condition somewhat improved. Physical signs unchanged. W.B.C. 14,000 (Polys. 72% ; lymphos. 28%).

Seen by Mr. Brock, who considered the clinical condition too poor to warrant bronchoscopy.

3.11.37 to 13.11.37 : Temperature swinging between 101° and 105° F. Physical signs unchanged.

15.11.37 : Clinical condition improved for past two days.

Bronchoscopy (Mr. R. C. Brock) : "Considerable œdema of larynx. In left bronchus half a peanut seen. Removed with some difficulty owing to macerated state of nut."

20.11.37 : Condition much improved. Physical signs slightly less marked.

Skiagram showed opacity at left base to be clearing.

2.12.37 : The child has shown continuous improvement in clinical condition and physical signs.

X-ray examination (Dr. Lindsay Locke) : " Median opacity normal. Diaphragms move evenly and well. Costophrenic angles clear. Mottled roots. Lungs clear."

Œsophageal Obstruction.—DAVID LEVI, M.S.

Patient, female, aged 11 years.

Family history.—Youngest of three healthy children. Mother and father healthy.

Past history.—Pneumonia several times in infancy and in 1933. Said to have had diphtheria twice ; second time in 1934. Appendicectomy 1934.

Present illness.—General health was good until after appendicectomy. Did not regain normal health after operation and was unfit for school. Vomiting came on suddenly before a meal in September 1935 and thereafter vomited after every meal. Was under observation in two hospitals where vomiting was thought to be functional.

General condition deteriorated, and patient lost weight. Collapsed in June 1936. Skiagram showed obstruction in œsophagus. Gastrostomy performed at Luton Children's Hospital, July 1936. Admitted to Infants Hospital January 1937. Had had gastrostomy feeds for five months and weight had improved.

On examination.—Thin child ; weight 39 lb. 12 oz. No abnormal physical signs except upper dorsal scoliosis.

Progress.—Gastrostomy feeds continued and small quantities of food given by mouth after passing the œsophageal tubes by the child herself before meals.

5.2.37 : Mercurial bougies passed before meals and gastrostomy feeds discontinued. Vomited all food taken by mouth and lost 1 lb. 8 oz. in three days. Skiagram showed bougie arrested in mid-œsophagus.

Skiagram on admission showed barium held up in upper end of œsophagus for some period, food subsequently passing into stomach. Appearance of stricture.

Œsophagoscopy showed marked stricture at region of 8th dorsal vertebra.

Œsophagoscopies repeated at intervals on following dates : 30.3.37 ; 17.4.37 ; 27.4.37 ; 13.5.37 ; 16.6.37 ; 30.6.37 ; 6.10.37 ; 30.11.37. Appearance of stricture similar on each occasion. Rubber bougies No. 10 passed with difficulty. Vomiting decreased for short time after each dilatation but recurred after short interval.

X-ray appearance unchanged. Wassermann reaction negative.

The general condition has improved considerably; weight now 52 lb. Gastrostomy feeds are given four-hourly and the patient does not vomit small quantities of fluid and semi-solid food.

Congenital Palatal Paralysis: ? Nuclear Agenesis.—RICHARD W. B. ELLIS, M.D.

Mrs. S., aged 28. Two healthy children. No familial history of neurological or other disease. She is said to have had difficulty in feeding as an infant. Speech was not acquired until after 4 years of age, and the voice has always had a nasal character. Speech is still often hardly intelligible. Patient cannot blow out her lips, or even blow out a candle. No regurgitation through nose recently. Apart from having had meningitis at age of 14, she has been otherwise well.

On examination.—A healthy woman of normal mentality, with nasal speech. Complete palatal paralysis. No other neurological lesion.

Comment.—The disability due to the palatal paralysis appears to date from birth. The history and limited nature of the lesions suggest nuclear agenesis.

Hilar Tuberculosis causing Pulmonary Collapse, in an Infant.—RICHARD W. B. ELLIS, M.D.

E. W., a breast-fed infant aged 7 months. Father and mother well. A previous child died of cerebral hæmorrhage. The mother's sister has active pulmonary tuberculosis, and had been in contact with the patient.

At the age of 13 weeks the baby began to have frequent cough and became increasingly dyspnœic. When seen at the Infants Hospital on August 24, 1937, he was wheezing continuously with inspiratory recession of the ribs and epigastrium. No cyanosis or clubbing. Apex-beat displaced a fingerbreadth to left of nipple line. Dullness in left upper zone anteriorly and posteriorly, with greatly diminished air-entry and harsh low-pitched breath sounds in this area.

He was admitted to hospital August 28. The Mantoux test (1 : 1,000) was strongly positive. He gained weight for the first week, when he began to have a low-grade pyrexia. The spleen was enlarged to two fingerbreadths below the costal margin, and he vomited several times. He was discharged home on September 25, 1937, still with temperature 99–100° F. and with the signs little changed. Since then he has been kept out of doors and breast-feeding continued. He has gained from 14 lb. to 15 lb. 10½ oz., and though the spleen is still palpable he is afebrile and the general condition has improved. There is now only occasional wheezing, with persistent dullness in left upper zone but with improved air-entry.

Blood-count (25.8.37): W.B.C. 14,000 per c.mm. (Polys. 49%; large hyals. 8%; lymphos. 43%).

Stomach washings: No tubercle bacilli seen on direct examination.

Radiological examination (Dr. B. Shires, 28.8.37): Displacement of heart to left and opacity in left upper zone. Appearance suggests collapse of left upper lobe (fig. 1).

6.9.37: Lobe re-expanding.

20.10.37: No change in left upper lobe. Increased emphysema in right.

30.11.37: Partial re-expansion of left upper lobe; emphysema in right lung and infiltration at right hilum (fig. 2).

Comment.—Collapse of lung secondary to tuberculous mediastinal lymphadenitis in children has been described by a number of authors, and the anatomical explanation of the condition recently clarified by Brock, Cann and Dickinson. It is probable that in some at least of these children the collapsed lobe subsequently

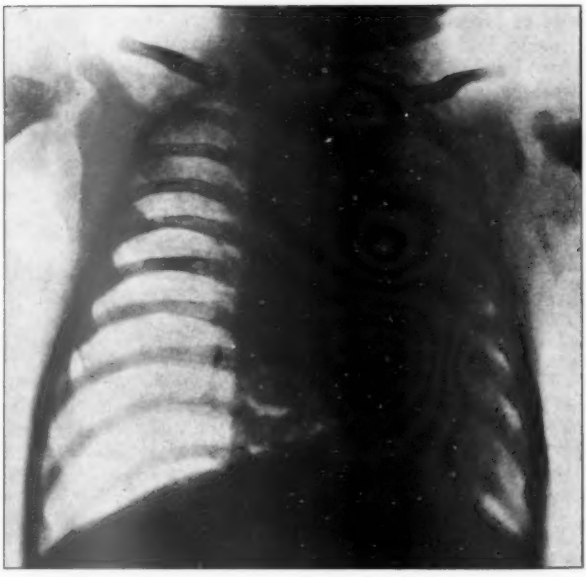

FIG. 1 (28.8.37).—Displacement of heart and collapse of left upper lobe.

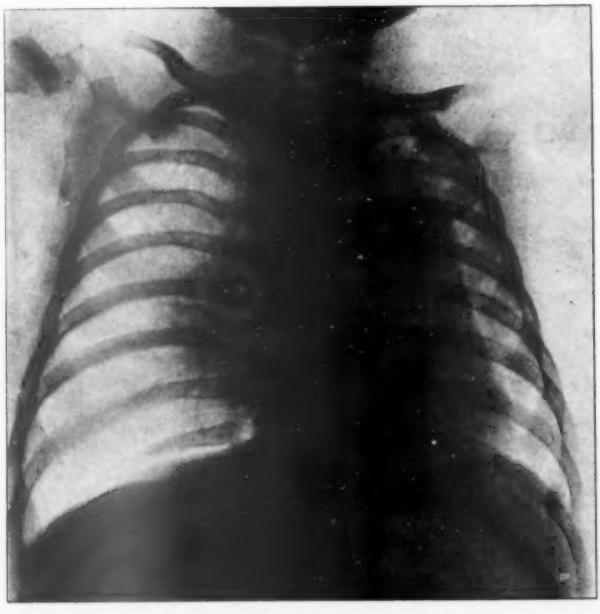

FIG. 2 (30.11.37).—Partial re-expansion of left upper lobe; emphysema in right lung and infiltration at right hilum.

becomes the site of bronchiectasis. In 1933 I reported the case of a 6½ year old girl in which lipiodol injection gave evidence of dilatation of bronchi or cavitation within a collapsed left lower lobe, and in which tubercle bacilli were recovered from the stomach washings. The present case is of interest from the age of the baby and the satisfactory progress up to the present time. Also, whilst one is frequently faced with the danger of a mother infecting her breast-fed baby with tuberculosis, it is rare to have to consider the possibility of a breast-fed baby infecting its mother.

References.—Brock, R. C., Cann, R. J., and Dickinson, J R , *Guy's Hosp. Rep.* (1937), **87**, 295 ; Ellis, R. W. B., *Arch. Dis. Childhood*, 1933, **8**, 41.

Section of Physical Medicine

President—F. D. Howitt, C.V.O., M.D.

[*December* 17, 1937]

DISCUSSION ON THE EFFECTS OF PHYSICAL TREATMENT ON THE ARNETH COUNT AND SEDIMENTATION RATE IN RHEUMATIC CONDITIONS

Dr. H. J. Gibson: Perhaps in no other disease is it more difficult to assess the results of treatment than in rheumatism. The patient's subjective symptoms are a very unreliable guide and the improvement in function which results from skilled physical and orthopædic treatment cannot always be taken as a criterion of the activity or otherwise of the underlying pathological process. In many diseases the death-rate or survival period is available as a sure index of success or failure of treatment, but in rheumatism even this is lacking.

The blood sedimentation rate has been the most generally applied index, the test being usually carried out on the blood as drawn from the patient, without much regard for the presence or absence of anæmia. More recently the age of the neutrophil polymorphs has been suggested as an indication of activity. Hill (1931) noted a shift to the left of the Arneth count in rheumatoid arthritis. Steinbrocker and Hartung (1933) concluded that a normal non-filament count excluded a diagnosis of rheumatoid arthritis. Short, Dienes, and Bauer (1937) gave a certain measure of support to this view, their opinion being that the non-filament count ranked next to the E.S.R. as a sign of activity.

These findings demanded confirmation with an adequate control series. If the age of the polymorph cells were affected by the disease the proportion of polymorphs would also require study, and this involved a differential count.

The methods which have been employed in this investigation are essentially those of Houghton (1936). Blood from a vein has been examined for sedimentation rate, Cooke-Arneth count, and differential count. The results have been studied to determine which, if any, of the factors concerned in the Houghton index it would be profitable to record in assessing the progress of a case of chronic rheumatism.

The Sedimentation Rate

The position of this test at present is far from satisfactory, owing to the widely varied techniques employed by different workers.

The points I wish to discuss are: (1) The anticoagulant used. (2) The diameter of the tube. (3) Anæmia as a factor in the test, and methods of correction for it.

The anticoagulant.—There are two principal methods in common use. The first involves the use of oxalate (sodium, potassium, ammonium or mixtures of these) without dilution of the blood or with minimal dilution. A concentration of 2 mgm. per c.c. is adequate to prevent coagulation and does not alter the shape of the red cells or seriously modify the tonicity of the plasma. Wintrobe and Landsberg (1935) showed that E.S.R. and red-cell volume were the same in oxalated as in heparinized blood. These workers preferred dry oxalate in the tube used to receive the blood. Race (1929) recommended rinsing the syringe with 20% oxalate solution. My own

method has been to use 0·1 c.c. of 10% potassium oxalate for each 5 c.c. of blood, this volume being partly in the syringe, where it prevents coagulation or hæmolysis, and partly in the tube. As coagulation of even the slightest degree renders the test valueless, oxalate in the syringe is highly desirable, especially when dealing with deformed arms and difficult veins, as in rheumatism.

The second method is the use of a measured volume of isotonic citrate, one part of citrate solution being added to four parts of blood. Following this treatment the red-cell concentration is lowered and the rouleaux-forming principle of the plasma is diluted—two very important modifications of an already complicated system. Lowering of the red-cell concentration accelerates the rate of fall, and dilution of the plasma causes slowing. Fahraeus (1921) showed that dilution of plasma by 20% could produce a very great slowing of the rate. If one part of citrate be added to 4 parts of whole blood the plasma dilution is approximately 1 : 3, since the cells remain apart.

A comparison between undiluted oxalated and diluted citrated blood was made in 46 cases. Blood was drawn in the same syringe without anticoagulant, and part was added to oxalate and part to citrate. Sedimentation rates were estimated in the Westergren tube. The results are shown in Table I. In most cases the retarding effect of plasma dilution appeared to outweigh the accelerating effect of diminution of red-cell concentration.

TABLE I.

Parallel S.R. estimations on blood of 46 cases, using as anticoagulant:—
1. 3·8% potassium citrate 1 part, to blood 4 parts.
2. 10% potassium oxalate 1 part, to blood 50 parts.
Westergren (200 × 2·5 mm.) tubes used for all tests.

	Cases
Fall greater in oxalated blood after 1 hr. and 2 hrs. ...	27
Fall equal in 1 hr. greater in oxalated at 2 hrs.	7
Total in which oxalated showed higher rate	34
Fall equal in both 1 hr. and 2 hrs.	5
Fall greater in citrated blood after 1 hr. and 2 hrs. ...	7
Where oxalated more rapid, mean difference = 6·4 mm.	
Where citrated more rapid, mean difference = 3·5 mm.	

Where dilution with citrate is practised it must be recognized that the rate recorded is an artificial one, being usually slower than with whole blood of the same patient.

Tube diameter.—The following tubes have been used :—

(1) Zeckwer and Goodell (1935). A conical centrifuge tube graduated in c.c. and tenths. This is filled to the 10 c.c. mark and readings are made of the R.B.C. volume in c.c. expressed as a percentage of the whole. The maximum bore is 15 mm. The height of a 10 c.c. column is 74 mm. A fall of 10% represents 5·5 mm. at the upper end of the tube.

(2) The Westergren tube as obtained commercially. The length is 200 mm., graduation being in millimetres. The internal bore in the tubes used varied from 2·4 mm. to 2·7 mm. The usual diameter is 2·6 mm. Readings are made of supernatant plasma in mm.

(3) An improvised " 5 mm. tube ", made from 5 mm. bore quill tubing, sealed flat at the bottom. A mark is etched 100 mm. from the bottom. Readings of the length of supernatant plasma are made by means of a millimetre scale.

(4) The Wintrobe tube, on which the previous tube was based. This is 3·5 mm. in diameter and is graduated in millimetres. It is designed to be used as a hæmatocrit tube as well as a sedimentation tube. The S.R. is read in millimetres of clear plasma ; a second scale is provided for reading off the red-cell volume. A large series of parallel tests has shown that there is no constant difference in the rate of fall between the 5 mm. and 3·5 mm. tubes.

Method of reading.—In this series all tests have been read at half-hourly intervals for two and a half hours. The method of Rourke and Ernstene (1929–30), where the

rate is noted at very short intervals so that the fall in mm./min. during the most rapid period can be estimated, has been found difficult to apply when 12 to 20 tests are being carried out simultaneously.

Influence of tube diameter.—Fahraeus (1921) used a tube 9 mm. in diameter, but since then, in an effort to reduce the volume of blood required, tubes of narrower bore have been used. A number of experiments have been carried out with tubes of different diameters. These show clearly that a marked delay occurs in tubes of about 2 mm. diameter. This is not invariable and where anæmia is present it is not found. The results suggest that the factors of tube-diameter and red-cell volume are intimately associated.

Table II shows how tube diameter influences the rate. Oxalated blood was tested in 4 tubes of bore 8 mm., 5 mm., 3 mm., 2 mm., respectively, the height of the blood column being 100 mm. in each case.

TABLE II.—INFLUENCE OF TUBE DIAMETER ON S.R.

Column of Blood 100 mm. *in each Case.*

	Diameter of tube			
	8 mm.	5 mm.	3 mm.	2 mm.
Fall in ½ hr. (mm.)	8	11	9	7
,, ,, 1 ,, ,, ...	48	50	45	22
,, ,, 1½ hrs. ,, ...	52	53	49	28
,, ,, 2 ,, ,, ...	54	55	51	33
,, ,, 2½ ,, ,, ...	56	56	53	35

It will be seen from Table II that the one-hour fall in the 2 mm. tube is less than half that in the 3 mm. tube. Repeated tests have indicated that in bloods of approximately normal red-cell content the limit of tube diameter which will permit free fall lies between 2 and 3 mm. It should be noted that the Westergren tubes obtainable commercially in this country have a bore of 2·6 mm., though variations above and below this are not uncommon.

Red-cell volume.—Fahraeus (1921) noted the profound influence of anaemia on the E.S.R. In one experiment he reported how the rate was doubled following a fall in red cells from 5 million to 4 million per c.mm. The fact of the importance of anaemia has been admitted by all, but the tendency is to shirk the complication which correction introduces into the test.

The following experiment, one of many, may be cited to show the magnitude of this influence :—

A specimen of oxalated blood was taken and 5 moieties were pipetted into small test tubes. From a centrifuged sample of the same blood, cells or plasma were added to give a considerable range of red-cell concentrations. Westergren tubes were filled from each, and at the same time the red-cell volume of each was ascertained by centrifuging. The results are shown in Table III.

TABLE III.—INFLUENCE OF RED-CELL VOLUME ON E.S.R.

All tests in Westergren (200 × 2·6 mm.) *tubes.*

Tube No.	Fall in 1 hour (mm.)	Fall in 2 hours (mm.)	R.B.C. volume %
1	83	108	30
2	15	70	35
3	2	7	38
4	3	10	45
5	3	7	47

It should be noted that red-cell volumes of 30% to 47% are of everyday occurrence in rheumatism, and the blood of the same patient may readily show considerable variation within this range. In this case the one-hour fall ranged from 3 to 83 mm.

Evidence of the effect of the interrelated factors of red-cell volume and tube diameter is seen in the following scatter diagrams of unselected routine tests.

Fig. 1 shows the good correlation between results of two methods where a tube of adequate diameter is employed, viz. Zeckwer and Goodell and 5 mm. tubes. It must be emphasized that these tubes are of different length, and one is read in terms of red-

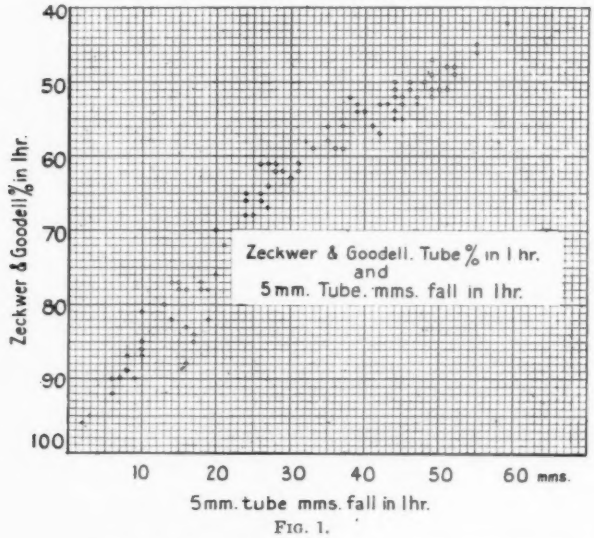

FIG. 1.

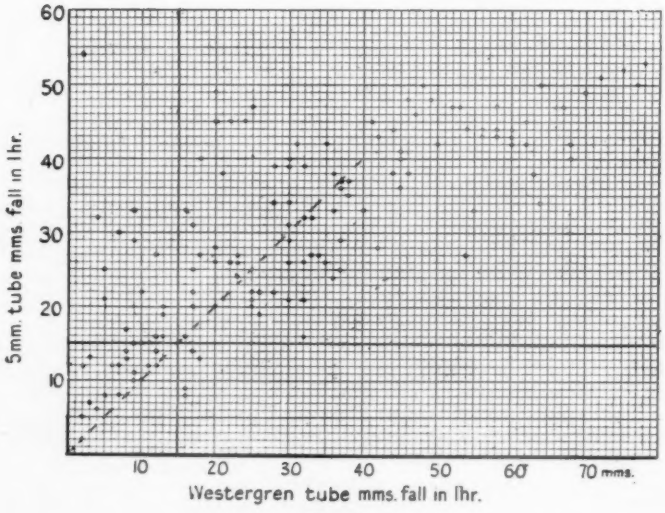

FIG. 2.

cell volume and the other in millimetres of free plasma. One is conical, while the other has parallel sides.

In fig. 2 is seen the very bad correlation between the 5 mm. tube one-hour reading

and the Westergren reading. Despite the 200 mm. length of the latter the major discrepancies are in the direction of retarded fall in the longer tube. The same tendency is shown by the comparison of Westergren with Zeckwer and Goodell methods. Correlations of the Westergren reading at 1 hour and the mean hourly reading with the Zeckwer and Goodell reading are also given (figs. 3 and 4).

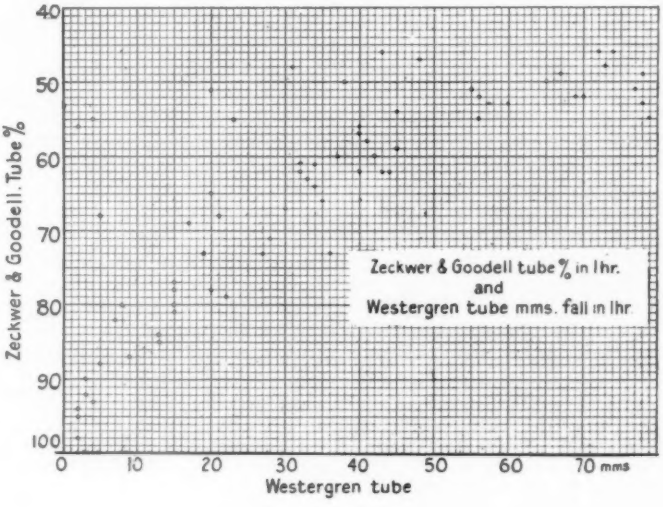

FIG. 3.

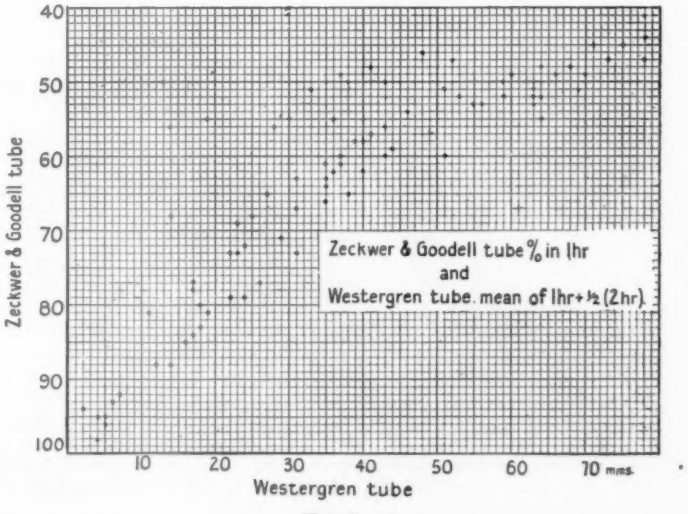

FIG. 4.

When dilution with citrate is employed the discrepancy is accentuated (fig. 5).

In all, 2,116 routine tests have been carried out in parallel, in Zeckwer and Goodell, Wintrobe, " 5-millimetre ", and Westergren tubes, and the results have been carefully reviewed.

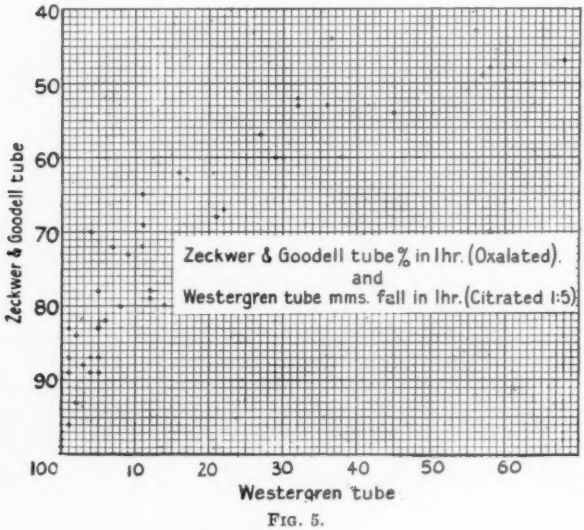

FIG. 5.

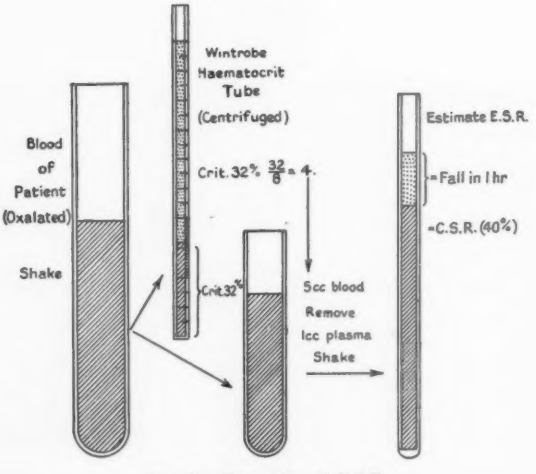

FIG. 6.—Correction of E.S.R.

One's impressions of the three methods of estimating the uncorrected rate may be summed up in this way. The best is probably the Zeckwer and Goodell method as modified by Race (1929). Seldom diverging from this are other tubes of reasonably

wide bore, e.g. 5 mm. or Wintrobe tubes. The Westergren tube gives erroneous results due to delayed fall in 5 to 10% of cases.

Methods of correction for anæmia.—Many methods have been suggested for the standardization of the E.S.R. so that adjustment for variations in the red-cell content may be readily made. Nearly all consist in the estimation of the rate in the original blood and correction by the use of a curve constructed from experimental data [Gram (1928), Rourke and Ernstene (1929–30), Wintrobe and Landsberg (1935), Walton (1933), and others]. Walton suggested as an alternative to the use of a graph the correction of the red-cell count *before* estimation of the E.S.R. He proposed that the red count be ascertained and that the count be then adjusted to 5 million per c.mm. by addition or subtraction of plasma. The method is one which appears to be eminently reasonable. The test involves two reagents, red cells, and plasma. The results of tests should be more comparable one with another if the reagents are present in the same proportions. This method has been tested in parallel with the three uncorrected methods and with Wintrobe's method of correction (fig. 1). The first practical difficulty in hospital work was the counting of 12–20 bloods before the sedimentation tests could be put up. This proved laborious but not an insuperable difficulty. More important was the fact that in rheumatoid arthritis the anæmia is essentially a hypochromic one of low colour and volume indices. A recent case (male) showed a red-cell count of 5·2 million, hæmoglobin 70%, and hæmatocrit reading of 33%. His red count would require that the blood be diluted, while his obvious anæmia in respect of hæmoglobin and red-cell volume called for a removal of plasma. In practice, therefore, correction for a red-count proved difficult to justify and not altogether satisfactory.

Correction for red-cell volume by Wintrobe's method has been used for a series of over 2,000 routine tests, as well as for a large number of experimental observations on artificially modified blood. A column of blood 100 × 3·5 mm. is observed at the end of one hour and the fall of red cells noted. The tube is then centrifuged and the red-cell volume is ascertained. As 20 or more of these narrow tubes can be spun at once in a centrifuge capable of taking small test tubes, the method is a very rapid one. The observed fall and hæmatocrit volume are then used in conjunction with Wintrobe's correction chart, and the theoretical fall for any other hæmatocrit reading may be ascertained. Wintrobe proposed 42% as standard R.B.C. volume for women and 47% for men.

In practice this method gives very uniform results over a considerable hæmatocrit range. Deviations of the observed from the expected rate occur when the red-cell volume is very high or very low (Table IV).

TABLE IV.—CORRECTION OF E.S.R. BY WINTROBE'S METHOD.

Observed fall in a specimen of blood modified by addition or subtraction of plasma. Rate corrected by Wintrobe's chart. Rate estimated in Wintrobe's tubes.

Tube No.	Fall in 1 hour (mm.)	Hæmatocrit. R.B.C. vol. %	Corrected S.R. mm./1 hour
1	14	49	16
2	20	46	19
3	21	46	20
4	38	42	*31*
5	51	37	*34*
6	53	34	*30*
7	56	32	*29*
8	59	30	27·5

In this case the fall observed ranged from 14 to 59 mm. per hour. The corrected rates for hæmatocrit values, 32 to 42%, were all near 30 mm./1 hour which would appear to be the true corrected rate. It was repeatedly found that the corrected rates were discordant when the red-cell volume was over about 42% and under 32%. In other words, a male's blood with normal red-cell volume (47%) does not fall freely

even though its plasma possesses abundance of the rouleaux-forming principle. Wintrobe himself noted this but pointed out that in pathological conditions the red-cell volume is rarely normal.

In gout, however, this state of affairs frequently exists. In a recent case a hæmatocrit reading of 54% (i.e. 7% above normal) was found to mask completely a very marked increase in S.R., which would have been undetected if the blood had not been retested after dilution with the patient's own plasma.

At the other end of the scale very active disease in a markedly anæmic patient causes the red cells to fall so rapidly that the possible fall may be completed twenty minutes after the test is set up. The one-hour reading required by the Wintrobe method is thus relatively a very low estimate of the true fall per hour, and the corrected rate is thus again unduly low.

For bloods of red-cell volume outside the 32 to 42% range the only possible correction method appears to be adjustment of the red-cell volume *before* the fall is observed—the principle employed by Walton.

To obviate the major fallacies in the test one would suggest :—

(1) Use of oxalated blood with minimal or no dilution.

(2) Use of a tube at least 3·5 mm. in diameter. Length is not of great importance but 100 mm. is a suitable figure, allowing as it does a fall of 50 mm. before packing commences ; 200 mm. would perhaps allow more latitude but it would require much blood if the tube-bore were adequate and it could not be centrifuged.

(3) Correction for red-cell volume.

The method at present being used with promising results is a combination of the Gram-Wintrobe method of correction for hæmatocrit reading with the Walton principle of adjustment of blood *before* estimating the rate. The steps are as follows (*see* fig. 6) :—

(*a*) The oxalated blood is thoroughly shaken and a Wintrobe or 5 mm. tube is filled and centrifuged to ascertain the red-cell volume. At the same time 5 c.c. are pipetted into a small test tube.

(*b*) Having ascertained the hæmatocrit volume, the 5 c.c. sample is adjusted to a red-cell content of 40% by addition or removal of plasma, the 5 c.c. volume being in practice brought to one-eighth of the hæmatocrit reading in cubic centimetres. 40% is chosen arbitrarily as being an R.B.C. concentration in which fall occurs freely in a tube 5 mm. in diameter. (*c*) The adjusted blood is then thoroughly shaken and a Wintrobe or 5 min. tube filled. The fall in one hour is then ascertained and reported as " corrected sedimentation rate (40%) ".

The Arneth Count in the Rheumatic Diseases

At the time when blood was taken for the S.R. a blood-film was made. All films were made, stained, and counted by me personally. The Cooke and Ponder standard was rigidly adhered to and Cooke-Arneth and differential counts were made on each film. Two hundred cells were counted for the differential count. This is admittedly a small number, but it was hoped that uniformity in making and traversing the films would compensate for the sampling error involved.

Results.—At an early stage of the work the wide spread of the results was noted. Though shifts to the left were common there were some remarkable exceptions.

In Table V are shown contrasting cases, both clinically typical of rheumatoid arthritis. One shows a shift to the right, such as is found in pernicious anæmia, and the other a shift to the left, of an order consistent with acute sepsis. In the group of rheumatoid arthritis weighted means from 1·4 to 3·2 were observed.

Such results indicated that only by means of statistical treatment of large numbers of cases could any approximation to the true neutrophil picture be achieved. This involved a series of normal counts from which differences and their significance could be calculated. Fifty-five counts of healthy adults were made. The subjects were

TABLE V.—LABORATORY FINDINGS IN TWO CLINICALLY SIMILAR CASES OF RHEUMATOID ARTHRITIS.

	Colston 7	Colston 10
Age	39	26
S.R. Zeckwer and Goodell	55%	53%
Westergren 1 hr. (mm.)	40	47
Westergren 2 hrs. (mm.)	91	90
Wintrobe (mm.)	45	47
Hæmatocrit	39%	39%
Corrected S.R. (mm.)	39	41
Weighted mean	*3·09*	*1·43*

physicians, nurses, office staff, massage staff, and others, all of whom were in good health, without history of recent illness. No elaborate selection was attempted, as it was realized that the average hospital rheumatic patient is not, apart from his rheumatism, a person of superlative physical fitness.

The normal count, fixed by Cooke and Ponder as 2·75 in carefully selected healthy subjects, is now known not to hold for all parts of the world (*see* Table VI).

TABLE VI.—THE NORMAL COOKE-ARNETH COUNT.

Author	Date	Place	Average weighted mean
Cooke and Ponder	1927	Wigan and Edinburgh	*2·75*
Kennedy and Mackay	1935/36	Iraq	1·994
Pai	1935	Moukden	2·07
Abels	1933/34	New York	*2·30*
Shaw	1936	Egypt	Egyptians 2·128
,,	,,	,,	British 2·077
McLeod	1935	Australia	2·64
,,	,,	Wigan	2·61
,,	,,	Colorado	*2·45*
,,	,,	Japan	*2·34*
,,	,,	Greece	2·31
,,	,,	Scotland	Rats 2·35
,,	,,	New York	,, 1·09
,,	,,	Scotland	Sheep 2·52
,,	,,	New York	,, 1·24

The factors concerned in producing these alterations have been carefully studied by the authors mentioned, but no final conclusions as to the precise cause have been reached. It is clear, however, that no valid comparison is possible between any series of Cooke-Arneth counts in disease and a hypothetical normal which may have a very local significance.

The average weighted means are given in Table VII, in which the standard deviation, standard error, and coefficient of variation are also tabulated. It will be seen

TABLE VII.—COOKE-ARNETH COUNTS IN NORMAL HEALTHY INDIVIDUALS AND IN CASES OF RHEUMATIC DISEASE.

Clinical group	No. of counts	Average W.M.	Standard deviation σ	Standard error of means	Coefficient of variation v (%)
Normal	55	2·434	0·2298	0·0322	9·40
Rheumatoid arthritis...	345	2·245	0·3347	0·0180	14·9
Spondyl.-ankylo. ...	62	2·347	0·2527	0·0321	10·76
*Osteo-arthritis ...	64	2·308	0·3657	0·0457	15·84
Fibrositis	89	2·331	0·3183	0·0335	13·66

* 10 cases of osteo-arthritis of femur with cysts showed a mean of 2·464 with σ = 1·049 and v = 43%. The range was 1·68 to 2·73.

that differences between the averages are not great among the various groups. Applying the usual test of significance of difference, it can be shown that rheumatoid arthritis and osteo-arthritis show a significant shift to the left as compared with normal. The differences noted among fibrositis, spondylitis, and normal are explicable as the result of chance. Weighted means in rheumatoid arthritis and osteo-arthritis are not significantly different from one another.

As a left shift is found to exist in rheumatoid arthritis the question may be asked if the weighted mean is correlated with any other laboratory finding in cases of that disease. Coefficients of correlation were calculated as shown in Table VIII. In assessing the significance, the criterion of twice the standard error of the coefficient was used. If the value for r exceeds this the relationship was probably not the result of chance.

The rather surprising result is seen that the only significant correlation is with the polymorph neutrophil percentage and that the coefficient has a positive value, i.e. as

TABLE VIII.—CORRELATION OF WEIGHTED MEAN WITH OTHER LABORATORY FINDINGS IN CASES OF RHEUMATOID ARTHRITIS.

Tests with which W.M. is correlated	No. of observation	Coefficient of correlation r	2 × S.E. of r	Significance
Sedimentation rate (Z. and G. %)	341	− 0·0574	0·1085	Nil
Hæmatocrit (males)	97	− 0·051	0·204	Nil
Hæmatocrit (females) ...	113	− 0·0834	0·188	Nil
Neutrophils (%)	202	+ 0·2184	0·1412	present Positive, doubtful
Lymphocytes (%)	203	− 0·1257	0·14	Negative
Monocytes (%)	217	+ 0·011	0·136	Nil
Eosinophils (%)	217	not calculated, obviously nil		

the neutrophil percentage increases, the weighted mean also increases, and this implies a shift to the right. As will be shown later, the polymorph proportion is significantly higher in rheumatoid arthritis than in the normal controls. Thus as the polymorph proportion moves from the normal the Arneth count moves towards the normal. Similarly, as the lymphocyte percentage falls, the Arneth count moves to the right.

Other indications pointing in the same direction may be seen in the table. The sedimentation rate (Zeckwer and Goodell method in which low values indicate a high rate) shows a negative correlation with the weighted mean as also does the hæmatocrit reading in both males and females. Thus, as S.R. and anæmia increase, there is a tendency for the Arneth count to move to the right.

This was noted at an early stage in the work, and subsequent clinical observation has suggested that a normal weighted mean or right shift is a bad prognostic sign in an established case. The absence of significant correlation between Arneth count and E.S.R. in rheumatoid arthritis was further emphasized by a study of cases in which tests were repeated at intervals of a month or more (*see* Table IX). As the E.S.R. is

TABLE IX.—RHEUMATOID ARTHRITIS; REPEATED TESTS. ASSOCIATION OF S-R. AND ARNETH COUNT.

		Arneth count			
		To right	To left	No change	Total
S.R.	Better	20	24	0	44
	Worse	17	17	1	35
	No change	4	1	0	5
		41	42	1	84

Omitting the "no change" figures which are small, and applying the method of X^2 it was shown that p was approximatey 0·90. That is the observed distribution may occur 90 times out of 100 by chance.

the proved criterion of activity in rheumatism, it must be concluded that this complete absence of correlation is a strong argument against the value of the Arneth count in the study of the results of treatment. Increase of E.S.R. and deflection of the polynuclear count appear to be measures of independent abnormalities in this group of diseases.

The Houghton Index in Rheumatic Disease

This simple numerical expression of the activity or otherwise of tuberculosis is derived from a consideration of S.R., Arneth or Bonsdorf count, and the differential leucocyte count.

It has been shown that the Arneth count is not a universally applicable criterion for expressing activity in rheumatism since the worst cases may have normal counts.

The differential count remains to be considered. The means are given in Table X.

TABLE X.—DIFFERENTIAL LEUCOCYTE COUNT IN THE RHEUMATIC DISEASES. (FIGURES ARE MEAN PERCENTAGE IN EACH CASE.)

Clinical Type	No. of cases	Neutrophils	Lymphocytes	Monocytes	Eosinophils
Rheumatoid arthritis	202	64·64	26·33	6·54	2·10
Spondyl-ankylo. ...	50	65·30	24·70	6·86	1·84
Osteo-arthritis ...	36	58·64	31·97	5·61	3·17
Fibrositis	51	58·14	33·29	5·93	1·56
Normal	55	57·33	33·82	6·10	2·40

As with the Arneth count, the spread of the figures was very great, but no attempt will be made to report the complete statistical findings.

It is sufficient to say that :—

(1) Regarding neutrophils, the mean percentages in cases of rheumatoid arthritis and spondylitis are significantly greater than normal.

(2) Regarding lymphocytes, the mean percentages in rheumatoid arthritis and spondylitis are significantly less than normal.

(3) All the other mean percentages reported are not significantly different from the corresponding normal value.

Cases of rheumatoid arthritis appear to be divisible into two ill-defined groups, according to their white cell picture (*see* Table XI). The lymphoid type, with a

TABLE XI.—CONTRASTING CASES OF RHEUMATOID ARTHRITIS ILLUSTRATING EXTREMES OF WEIGHTED MEAN AND POLYMORPHONUCLEAR PROPORTION: BOTH FEMALES.

	Case A.P.	Case K.B.
Age	63	19
S.R. (Z. and G.)	58%	38%
Wintrobe	42 mm. fall	64 mm. fall
Hæmatocrit	37%	28%
Weighted mean	1·42	3·15
Polymorphonuclears	25%	80·5%
Lymphocytes	59%	12%
Monocytes	15%	5%
Eosinophils	0·5%	1%

neutropenia of varying degree, is associated with a shift to the left; the extreme example of this type is seen in Felty's syndrome, as in the recent cases described by Collins (1937) when the white-cell picture simulated agranulocytosis. These findings are consistent with infection. The second type is more difficult to explain; although the patients are anæmic and emaciated with every evidence of toxæmia, they show a polymorph preponderance with a shift to the right of the Arneth count. Toxins, if present, appear to attack the lymphocytes, while the polymorphs grow old and relatively numerous. These findings are unlike those in any infective process. It is difficult to see that the leucocyte picture in rheumatism, taken as a whole, gives evidence either for or against an infective ætiology.

If any conclusion is possible it is that the E.S.R. remains of outstanding importance as a test of success or failure in treatment. It appears, therefore, to be essential that every precaution be taken to ensure the accuracy of that test so that it may be a method for precise quantitative measurement and not, as at present, a more or less vague qualitative test.

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Dr. L. C. Hill: The subject of this discussion has probably not escaped criticism from those who would confine our scope to the immediate problems of physical medicine, but all those who practise physical medicine must be brought constantly into contact with the rheumatic group of diseases, and in order that physical treatment shall be intelligently administered, some reliable diagnostic test and if possible, some therapeutic measuring-stick, is necessary.

From this standpoint alone, and there are many others, the inclusion in the programme of such a discussion as this is justifiable, and in this connexion I would remind members of a phrase in our president's opening address in which he solemnly exhorted us to " widen our horizon so as to include medicine ".

Uses of the Polynuclear Count

Unfortunately at the moment there is a complete lack of any reliable specific diagnostic test for the various rheumatic diseases, but certain methods exist whereby clinical observations on progress and the value of treatment can be confirmed or otherwise. These tests have been used with varying success in different hands.

The most important so far are undoubtedly the sedimentation rate of the erythrocytes, the nuclear count (a determination of the number of younger or more immature polymorphs in the blood), the Vernes resorcinol (flocculation) test, and the agglutination reaction.

Recent work by Short, Denis, and Bauer has endeavoured to evaluate the accuracy and usefulness of these four tests in a series of cases of rheumatoid arthritis.

The results show a high degree of correlation between the sedimentation rate and the Arneth count, the former being slightly ahead in accuracy (92% to 87%). Both are entirely non-specific, but are far superior to the other two, as regards the diagnosis of activity. The Vernes test showed up badly, being inaccurate in 50% of cases as well as non-specific, while the agglutination test, from which much was expected on account of its claims to being specific, was also only accurate in about half of the cases. The disappointing lack of uniformity in the results obtained by different workers using the agglutination test renders it of little value as a routine investigation.

Various forms of immature polymorphs.—The basic idea behind the nuclear count is the estimation of the maturity of the polymorphs, and I propose to run the risk of boring you with some elementary facts about the early life of, and the various steps in the development of, the polymorph.

The granulocytes (neutro-, baso-, and eosinophilic leucocytes) arise outside the blood-vessels in the marrow and pass into them by virtue of their own mobility. The cell from which they arise is a matter on which there is considerable difference of opinion, but is generally considered to be the reticular cell which occurs sparsely in the interstices between the fat cells. The cytoplasm of these cells is only faintly basophilic and has no granulation. The nuclei stain poorly and are virtually invisible. The primitive free cell is derived from the reticular cell by repeated division and is similar, save that it is more basophilic.

The myeloblast is the next stage. Here basophilia reaches a maximum and there are no granules. The nucleus is relatively large and of fine chromatin structure

containing nucleoli. The cells vary in size, but the majority are large, and are essentially typical of myeloblastic leukæmia.

The myelocytes differ mainly in the amount of granulation in the cytoplasm. The nucleus becomes smaller and gradually loses its fine chromatin structure and its nucleoli, and the cytoplasm develops granules and becomes less basophilic.

The metamyelocyte is a cross between a myelocyte and a polymorph. It is a convenient term in which to describe the stage when amœboid movements begin. The cell is often found in the normal blood, although it is essentially a marrow cell. It differs from a myelocyte by the indented nucleus and from the leucocyte by its larger size. Thereafter the cells are of approximately uniform size due to the cessation of all division, and are functionally mature leucocytes.

Leucocytes enter the blood-stream rhythmically with hourly accessions and a larger rise in the afternoon. They are amœboid to begin with, but as they become older their mobility lessens, and the senile leucocytes are non-mobile. The nuclei gradually split up, the lobes becomes differentiated, and the junctions gradually contract to the point of becoming a mere chromatin filament. The senile leucocyte is fragile and easily ruptures, and the granules stain poorly. Senile non-mobile leucocytes appear in the blood in showers, indicating that part of them die in the blood-stream but part pass out into the tissues to die.

Methods

Various methods have been described :—

(1) *The Schilling count.*—This includes the various forms of myelocytes and the metamyelocytes, the younger with the slight indentation and the older with the pronounced indentation. These are added together and the total is expressed as a percentage of the whole polymorph count.

(2) *The Arneth count.*—Here the number of lobes is counted independently of any connecting tissue, whether broad bands or fine filaments. The result is expressed as the average number per polymorph.

(3) *The Cooke-Arneth count* is a modification of the Arneth count. Here the nuclear lobes, in order to be counted, must not have more than a fine chromatin filament as the connecting link.

(4) *The filament–non-filament count.*—This is less well known than the others and appears exclusively in American literature. It consists of an estimation of the ratio between those cells with filamentous junctions and those without.

The technical difficulties are so great that the results must always depend on the personal equation. One of the main problems is that of deciding whether the connecting link is a fine thread, two fine threads, or a bar. The polymorphs are spheres and not discs, therefore the plane of examination may result in two nuclei being superimposed.

In 1929 I endeavoured, by applying the Arneth count as modified by Cooke to the rheumatic group of diseases, to ascertain its value as a clinical test. The result showed a considerable dislocation to the left in infective arthritis, a slight shift in subacute rheumatism (including convalescence from acute rheumatism), in menopausal arthritis, and in gout, and virtually no change in fibrositis.

Unfortunately on that occasion I failed to include osteo-arthritis in the investigations.

The number was too few (only 50 cases in all) to be of any real value except to stimulate interest in the then little-used method.

The phrase "shift to the left" refers to the increased proportion of immature polymorphs. It is known to occur in all types of infective disease and also in certain toxic conditions such as diabetes, nephritis with uræmia, &c. In rheumatoid arthritis the shift occurs in the absence of any increase, or even with a possible decrease, in the total cell count, as also in typhoid fever. The more rapid destruction of the more

mature forms or some interference with the process of maturation would appear to explain the phenomenon more satisfactorily than an increase in bone-marrow activity.

At that time I concluded that the Cooke-Arneth count gave a roughly accurate picture of the infection present and corresponded closely with the sedimentation rate, the ease with which the one drop of blood required for the test could be obtained as compared with the occasional difficulty in arthritic patients of finding an adequate vein, enhancing its value in certain cases.

A series of 48 cases of rheumatoid arthritis (Table I) and 20 cases of osteo-arthritis of the hips (Table II) has been studied, from the point of view of the sedimentation rate and the Cooke-Arneth count.

In all the rheumatoid cases the suspension stability level was below 82%, the average being 53·9, and only eight were above 60%. The normal level in health is about 95%.

TABLE I.—RHEUMATOID ARTHRITIS.

On admission		After treatment with gold in conjunction with hydro- and physiotherapy for from 6 to 9 weeks	
Sedimentation rate	Cooke-Arneth count	Sedimentation rate	Cooke-Arneth count
%		%	
51	1·86	—	—
56	2·06	50	1·89
52	1·76	52	—
52	1·91	54	1·80
45	1·92	46	1·87
45	1·73	48	1·67
61	1·97	62	1·84
53	1·88	52	—
50	1·90	55	1·66
57	2·18	—	1·66
81	2·12	—	—
52	1·90	56	1·92
41	1·72	—	1·78
43	1·98	53	1·67
52	1·69	61	1·68
52	1·77	52	1·94
53	1·82	60	—
51	2·12	62	2·10
48	2·09	42	2·11
60	2·24	55	1·94
53	1·87	55	1·90
45	1·79	47	1·82
64	1·74	77	1·72
53	2·00	49	2·06
61	1·76	64	1·86
45	1·94	60	1·98
57	1·88	60	2·06
53	1·80	69	1·64
49	1·94	49	1·98
63	1·90	62	1·72
53	1·50	45	1·58
59	2·03	54	—
50	2·00	62	—
53	1·94	61	1·88
58	1·96	57	1·86
37	1·86	42	—
50	2·22	55	1·77
54	1·88	—	2·03
55	1·91	60	1·82
58	1·74	55	1·95
70	2·38	80	1·72
52	1·74	53	1·76
55	1·83	57	2·15
51	1·77	55	1·68
63	1·82	66	1·91
58	1·80	56	1·82
72	2·27	85	2·08
47	2·00	51	1·93

TABLE II.—OSTEO-ARTHRITIS OF THE HIP.

On admission		After-treatment with arsenic in conjunction with hydro- and physiotherapy for from 6 to 9 weeks	
Sedimentation rate	Cooke-Arneth count	Sedimentation rate	Cooke-Arneth count
%		%	
69	1·82	73	2·00
48	1·94	47	1·82 cysts
—	1·50	—	1·56 cysts
—	1·86	—	1·53 cysts
—	1·87	—	2·04
—	1·76	—	1·83 cysts
60	1·79	80	1·99 cysts
68	2·40	61	2·61
74	2·08	76	1·99 cysts
98	2·97	98	2·90
—	2·78	—	—
—	2·18	—	—
85	2·53	61	—
84	2·09	84	—
92	1·89	96	—
—	2·48	—	2·24
72	1·73	73	—
68	1·90	71	1·84 cysts
73	2·25	69	2·28
—	2·04	—	1·87

In the same group of cases the highest weighted mean was 2·38 and the lowest 1·50, the average being 1·91. Only 13 were above 2·00 and only 4 above 2·20. The normal in health is 2·50 or over.

The rheumatoid arthritics were treated for six to nine weeks with baths, physiotherapy, and gold, and both tests were repeated at the end of this period.

In 20 cases of osteo-arthritis the Cooke-Arneth count varied between 1·50 and 2·97, the average being 2·09. Ten were above 2·00 and six above 2·20. In only 12 of this group was the sedimentation rate estimated, and it varied between 48% and 98% with an average of 74·3%.

These cases of osteo-arthritis of the hips were treated by baths, physiotherapy, and arsenic by mouth to the limit of toleration. No appreciable effect could be noted in either the Cooke-Arneth count or the sedimentation rate at the end of this period.

My own impressions of some of the significant points arising out of these figures are as follows :—

(1) There is a significant shift to the left in the Cooke-Arneth count in both rheumatoid arthritis and osteo-arthritis. In the case of rheumatoid arthritis the shift is more pronounced and more consistently present.

(2) The degree of shift to the left in rheumatoid arthritis is paralleled by an increase in the sedimentation rate. The shift in osteo-arthritis, though less than in the rheumatoid group, is proportionately greater than the increase in the sedimentation rate.

(3) The greatest shift to the left in osteo-arthritis appears to occur in those cases in which evidence of cystic areas is apparent by X-ray. Not enough cases have been examined to dogmatize.

(4) The effect of six to nine weeks' treatment of 48 rheumatoid arthritics by baths, physiotherapy, and gold tends to produce a slight improvement in the sedimentation rate at the end of that period. This improvement, in the majority of cases, lags behind the clinical picture. There is some evidence to hand that in three or four months' time that lag is made up and an appreciable improvement in the sedimentation rate occurs.

(5) The Cooke-Arneth count is not significantly altered by the same treatment over the same period. If anything there is a deterioration or increased shift to the left. The tendency for improvement to occur at the end of three or four months, as in the case of the sedimentation rate, is not evident.

(6) The number of cases of osteo-arthritis undergoing arsenic treatment in addition to physiotherapy is too small to warrant conclusions, but there appears to be no significant effect upon either the sedimentation rate or the Cooke-Arneth count.

(7) The sedimentation rate appears to be more valuable, both as a diagnostic test and a therapeutic measuring-stick. In the latter case, however, it appears to lag behind clinical evidence of improvement. I entire agree with Dr. Gibson with regard to the relative accuracy of the centrifuge tube method of estimating the sedimentation rate as compared with the Westergren and capillary tube methods.

(8) Any correlation between the sedimentation rate and the Cooke-Arneth count is too low to have any real significance.

(9) No cases of a shift to the right in rheumatoid arthritis, similar to those described by Dr. Gibson, have been met with. This may possibly be due to the fact that at the Devonshire Royal Hospital we do not see the very early acute cases since the hospital is run on ambulatory lines, and there is usually a six- or eight-weeks' waiting list.

[I have to thank Mr. J. Race, Biochemist at the Devonshire Royal Hospital, for his advice and help in this investigation.]

Dr. Douglas H. Collins : I have recently made observations on the total and differential leucocyte count, the Arneth count, and the sedimentation rate (S.R.) in persons with chronic rheumatic disease, immediately before and after single applications of certain physical treatments. I have also made Arneth counts at weekly intervals on rheumatic patients undergoing courses of physical treatment and on other persons suffering from osteo-arthritis of the hip-joint. The results of these observations will here be described and briefly discussed.

Laboratory technique.—Total white cell counts were made from 1 : 20 and 1 : 100 dilutions of blood in double Neubauer counting chambers. Differential counts were made from 300 cells in Giemsa-stained smears. The Arneth count was performed according to the technique of Cooke and Ponder (1927), and is expressed as the weighted mean of the polynuclear count, or average number of nuclear lobes in each polymorph. A low weighted mean (W.M.) thus indicates a " shift to the left " of the Arneth count. A W.M. of 2·40 or more is considered normal. The sedimentation rate of erythrocytes has been determined by the technique of Walton (1933), which employs a graduated parallel-sided tube 6 mm. in diameter into which 1 c.c. of citrated blood (1 part of 3·8% citrate to 9 parts of blood) is introduced, and this forms a column of blood 32·5 mm. in height. The S.R. is expressed as the fall in millimetres at the end of one hour when the corpuscular content of the blood has been corrected to a standard of 5,000,000 cells per c.mm. A sedimentation rate of 5·5 mm./hr. or less is normal, and the maximum rate we have ever observed was one of 21·0 mm./hr. Simultaneous tests have also been made in many cases by the Westergren method, but these results, which were somewhat anomalous, are not recorded here.

The immediate effect of a single physical treatment on the blood leucocytes, Arneth count and S.R.—Blood was collected from the ear for purposes of cell count and smears, and from an arm-vein for S.R. immediately before and about five minutes after 29 treatments given to 28 patients. The results are shown in Table I. The total and differential cell counts were repeated at intervals of from one to twenty-four hours after the treatment in some cases. The treatments concerned were : 10 immersion baths (saline sulphur water—102° F.—20 mins.) ; 3, general dry massage ; 7, wet massage (Vichy massage douche) ; 5, radiant heat to a large area of body surface ; 3, general diathermy ; 1 Berthollet steam-bath for upper and lower limbs.

The reactions to these various forms of physiotherapy did not differ materially from group to group and may, therefore, be considered together. The majority of patients

TABLE I.—THE IMMEDIATE EFFECT OF A SINGLE PHYSICAL TREATMENT UPON THE BLOOD LEUCOCYTES, THE POLYNUCLEAR (ARNETH) COUNT AND THE SEDIMENTATION RATE OF R.B.C.

Sex	Age	Total W.B.C. per c.mm.		Polymorphs. %		W.M. of Arneth count		S.R. mm./hr.	
		Before	After	Before	After	Before	After	Before	After
		IMMERSION BATH (Saline Sulphur Water—102° F.—20 mins.).							
M.	66	26,700	10,800	66·0	56·0	2·00	2·07	3·0	4·5
M.	17	18,400	7,600	74·0	73·0	1·84	1·85	12·0	12·0
M.	63	14,400	10,400	58·0	58·3	2·36	2·25	1·5	1·5
M.	31	12,800	12,900	54·6	49·6	2·49	2·47	6·0	6·0
M.	40	12,500	9,300	65·6	65·0	2·28	2·25	11·0	14·5
M.	58	12,100	12,300	69·3	71·3	2·31	2·27	1·0	1·0
M.	52	10,800	7,800	68·0	63·0	1·89	1·97	7·0	8·5
M.	56	—	—	61·0	55·0	2·28	2·18	5·0	7·0
M.	58	—	—	55·0	74·0	2·51	2·31	14·0	14·0
M.	53	—	—	39·0	37·0	2·56	2·51	2·0	2·0
		DRY MASSAGE.							
F.	52	14,300	8,200	57·3	72·0	1·87	1·93	14·0	14·0
M.	25	9,100	8,700	71·0	60·0	2·58	2·48	4·5	5·5
F.	57	5,000	8,200	43·0	47·0	2·07	2·12	7·0	7·0
		WET MASSAGE (Vichy massage douche).							
M.	56	24,600	13,000	76·6	67·3	2·25	2·42	3·0	3·5
M.	30	20,500	7,700	66·5	63·0	2·49	2·46	5·0	5·5
M.	52	15,000	13,900	66·0	66·0	2·38	2·29	3·0	3·0
M.	41	14,500	16,300	61·3	61·0	2·38	2·33	1·5	1·5
M.	37	12,000	10,800	74·0	76·0	2·04	2·04	17·0	17·5
M.	48	9,100	9,400	66·0	66·0	2·06	2·05	10·0	10·0
M.	38	6,200	6,600	61·4	62·0	2·09	2·12	2·5	2·5
		RADIANT HEAT (full length of spine).							
F.	40	18,400	9,000	65·3	61·6	1·97	2·02	8·0	10·5
M.	45	14,600	5,200	70·0	58·0	2·23	2·25	5·0	5·0
M.	33	12,000	13,600	61·3	68·6	2·08	2·07	2·0	1·5
M.	41	10,700	14,500	72·0	66·6	2·16	2·17	16·0	16·0
M.	36	9,200	7,600	63·3	56·3	2·33	2·29	0·5	1·0
		DIATHERMY (General).							
M.	33	18,000	9,300	63·0	66·0	2·02	2·05	—	—
M.	25	12,200	7,800	56·0	57·6	2·19	2·19	15·0	14·5
M.	55	—	—	64·6	50·0	1·95	1·93	9·5	9·5
		BERTHOLLET (Steam bath for arms and legs).							
F.	57	9,000	6,000	53·0	38·0	2·11	2·18	7·0	7·0

showed an initial leucocytosis which was apparently not due to any physiological cause. In 5 instances there was no significant alteration in the total number of W.B.C., in 4 instances there was an increase, and in 16 there was a decrease in the total leucocytes, which sometimes fell to 40% of the initial count. In those cases in which the total leucocyte count fell, the polymorph percentage also fell significantly in 6, remained the same in 9, and rose in one. Fall in the polymorph percentage was noticed in one instance when the total W.B.C. increased, in 2 instances when the total W.B.C. remained at the initial level, and in 2 cases in which numerical counts were not made. The total number of leucocytes decreased in 14 out of 19 patients (74%) with an initial leucocytosis (more than 10,000 per c.mm.), and in 2 out of 6 patients (33%) with a normal initial leucocyte count.

It may be concluded, therefore, that in these forms of physical treatment, none of which demand active exercise and all of which tend to promote physical and mental relaxation, a fall in the total leucocyte count is a frequent immediate reaction, that this fall affects all types of leucocytes but sometimes the polymorphs more than others, and that this type of reaction is especially frequent and pronounced when there is an initial leucocytosis. In this connexion we may recall the work of Martin (1932) who demonstrated the immediate numerical rise of leucocytes after active exercise, and of Garrey (1929) who found that a recumbent posture, with complete mental and physical relaxation, reduced the number of leucocytes to a minimum. Subsequent tests on some of these subjects showed that the reduction in the number of leucocytes

was a temporary effect and that increase occurred again within one hour of the completion of the treatment ; probably the result of resumption of muscular activity.

The effect of treatments on the leucocyte count proved of greater interest than their effect upon the Arneth count, though this latter was the first object of our investigations. Allowing for a 5% experimental error in the W.M., physical treatments only brought about a " shift to the left " once and a " shift to the right " once, a fact which shows that neither the young nor the mature polymorphs are specifically affected in the numerical alterations.

The S.R., likewise, was not materially affected by any single treatment. In 5 instances it was slightly increased, but these increases never exceeded 2·5 mm./hr., and are of little significance.

The Arneth count in chronic rheumatism during a course of physiotherapy.—The Arneth count has been made on 16 patients undergoing five to six weeks' courses of physiotherapy, together with the internal administration of mineral waters, at the Harrogate Royal Bath Hospital. The Arneth count usually remains very stable throughout the course of treatment and does not reflect clinical progress as accurately as does the S.R. Two typical examples are shown in Chart I.

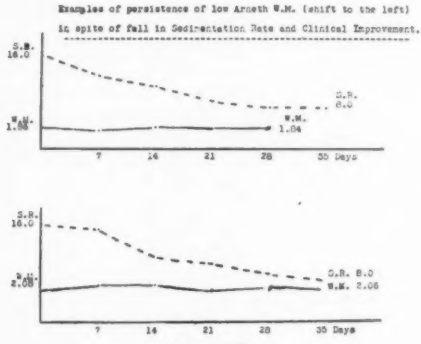

CHART I.

The Arneth count in osteo-arthritis of the hip.—In a previous publication (Collins : 1936) it has been shown that a well-marked " shift to the left " is quite often found in osteo-arthritis of the hip, and that this is associated with the radiographic demonstration of many, or large, cyst-like areas of rarefaction in the bones forming the affected joints. These results have now been confirmed by the examination of a further 17 cases, and the incidence of " shift to the left " in the total of 34 cases is shown in Chart II. Cystic areas of rarefaction were described by Thomson (1929), and have been identified in 20 out of the 34 patients with " morbus coxæ senilis " that are here reported. Their obvious presence is often associated with pain and progression of the arthritis. Osteophytic outgrowths, narrowing of the joint-space, and moulding of the head of the femur may co-exist with these cystic areas. Their demonstration is often missed owing to the use of a ray not sufficiently penetrating to show the internal structure of the bone. Pathological examinations of these cysts have been few, but it appears that they are degenerative rather than inflammatory in origin, and they are not of the osteoclastomatous nature of some other bone cysts. In the 14 " non-cystic " cases, the bone usually appeared more sclerotic, and these may represent a later or healing stage of the same disease process, or possibly they may be of a quite different ætiology. None of these cases showed any resemblance to the atrophic or rheumatoid type of arthritis. The S.R. is usually low in both types of osteo-arthritis and was rapid in only one patient (a " cystic " case) so tested. We cannot assume that the " shift to the left " indicates the infective nature of this disease of

the hip-joint. There is no pathological substantiation for this, but it is now clear that true osteo-arthritis of the hip is quite distinct from the simple "osteophytosis" around joints or spine, to which the term osteo-arthritis should never be applied; the Arneth count may continue to prove of value in their differentiation. Experience

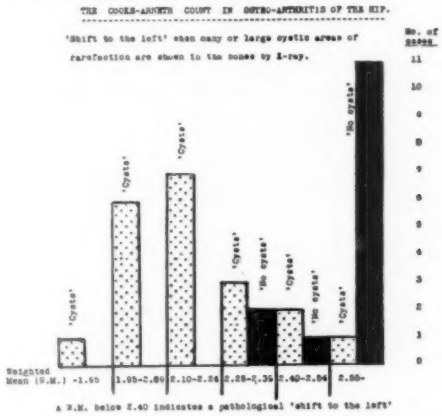
THE COOKE-ARNETH COUNT IN OSTEO-ARTHRITIS OF THE HIP.
'Shift to the left' when many or large cystic areas of rarefaction are shown in the bones by X-ray.
No. of cases
'Cysts'
'No cysts'
Weighted Mean (W.M.) -1.95
1.95-2.09
2.10-2.24
2.25-2.39
2.40-2.54
2.55-
A W.M. below 2.40 indicates a pathological 'shift to the left'

CHART II.

with the Arneth count in this disease also suggests that the count may be influenced by a local bone pathology which is quite independent of the general condition of the patient as reflected in the S.R.

Comparison of S.R. and Arneth count as a clinical laboratory test in the rheumatic diseases.—I do not consider that the Arneth count is as satisfactory a test in its clinical application as is the sedimentation test. It is less rapidly restored to normal with clinical improvement and I have elsewhere shown (Collins: 1936) that it may remain deflected to the left in cases of rheumatoid arthritis of great chronicity. It has very little prognostic significance in chronic rheumatism and local bone pathology may cause an abnormality of the Arneth count which is not consistent with any strict clinical interpretation that may be put upon it. Although, in my experience, there is a rough correlation between "left shift" and increased S.R. in a series of cases, wide discrepancies may be met with in individuals. A standardization of technique for estimating the S.R. is, however, much needed, especially by workers in the rheumatic field. I believe that a method using a wide-bore tube and a short column of blood, as in the Walton method, gives more consistent results than does the use of a long narrow tube, as in the Westergren test. The results ought to be expressed after correction for abnormal corpuscular content of the blood has been made.

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Dr. W. Yeoman: My observations are based on a series of 28 cases treated at the Harrogate Royal Bath Hospital during the past nine months. All were of the rheumatoid type and they were specially investigated to see what effects, if any, physical treatment had on their sedimentation rates. The sedimentation rates were taken before treatment was begun and on the day before the patients left

hospital, and in 17 of them Dr. Collins also carried out three or four additional estimations during their stay. The Walton method was used in each case.

All the cases were under my own care, and though no effort was made to give a uniform type of treatment I was interested to find on looking through the notes that only two cases did not have the sulphur waters to drink, and all except two had sulphur baths. In addition to the above, all had either the magnesia water and Kissengen water to drink and some form of local physical treatment such as Berthollet steam baths, paraffin wax, radiant heat, and massage. In 5 cases a course of gold treatment was started in the hospital in the form of solganol, but no case received more than 6 injections and 5 cases had injections of œstroform or progynon. Two cases had courses of induced hyperpyrexia, colloidal sulphur being used in one and intravenous T.A.B. vaccine in the other.

I have divided the cases into two groups. The first group (Table I) did not have glucose and the second group (Table II) did.

TABLE I.—GROUP 1.

No.	Sex	Age	Sedimentation rate Before	Sedimentation rate After	Wt. in lb.	Result
1	M.	55	14·0	12·0	+ 4	++
2	F.	38	17·0	13·0	I.S.Q.	++
S. 3	F.	36	15·0	12·0	I.S.Q.	++
G. 4	M.	55	14·0	16·0	I.S.Q.	++
O. 5	F.	47	13·0	8·0	I.S.Q.	++
O. 6	F.	44	14·0	12·0	I.S.Q.	I.S.Q.
O. 7	F.	44	16·0	15·0	+2	++
G. 8	F.	43	14·0	16·0	+3	Worse
O. 9	F.	31	17·5	14·0	+4	++
G. 10	F.	63	14·5	10·0	+3	++
11	F.	46	10·0	17·0	+3½	++
O. 12	F.	32	14·0	12·0	I.S.Q.	++
G. 16	F.	26	12·0	4·0	+2	+
	Readmitted		3·0	3·5	+ ½	+
21	F.	45	14·0	15·0	+1½	+
22	F.	24	17·5	12·0	+4½	++
23	F.	44	16·0	7·0	−5½	I.S.Q.
24	F.	22	11·5	9·5	+1	++

In this series 13 showed improvement in the sedimentation rate on leaving (= 76%).
Average stay in hospital thirty days.

S. = Intramuscular injections of colloidal sulphur.
O. = Œstroform injections 10,000 units twice a week.
G. = Gold injections.

TABLE II.—GROUP 2.

No.	Sex	Age	Sedimentation rate Before	Sedimentation rate After	Wt. in lb.	Result
13	F.	34	14·5	10·0	I.S.Q.	++
*14	F.	36	12·0	15·0	+2	Worse
*15	F.	19	15·0	16·0	+3	+
17	F.	21	9·0	5·0	−3	+
*18	F.	47	15·5	16·5	I.S.Q.	++
19	F.	38	18·0	14·5	I.S.Q.	+
*20	F.	55	16·0	15·0	I.S.Q.	+
25	F.	13	17·0	8·0	+4	+++
*26	M.	40	17·5	18·0	−2	++
*27	F.	39	12·5	15·5	I.S.Q.	++
*28	F.	30	13·5	15·5	+2½	++

Patients in this series were given 100 grammes of glucose a day for fourteen days in addition to the ordinary hospital diet.
* Indicates the cases in which the joints were worse during the glucose administration.
Four showed improvement in the sedimentation rate on leaving.
+ = 36% as compared with 76% in last series.
Average stay in hospital thirty-eight days.

Consideration of the first group shows a definite improvement in the sedimentation rate of 13 out of the 17 cases. For brevity I have assessed the degree of clinical improvement by means of plus signs. In doing this the patient as a whole was taken into consideration and not only the improvement in the joints. In this I pay great attention to the sweating of the palms of the hands and soles of the feet, for I consider if there is an improvement in the characteristic clammy feel in these areas the patient is recovering from the active stage of the disease.

It would take too long to give a detailed account of each case, but I am selecting four from this series in order to call attention to interesting points.

Case 5.—A woman at or about the menopause. She had had two normal confinements. Rheumatism began in 1934. Wrists, shoulders and elbows were affected; diagnosis confirmed by X-rays. She had sulphur water and magnesia water to drink, sulphur baths and massage and 6 injections of progynon, of 10,0000 units. She was in hospital twenty-seven days, and the sedimentation rate showed a drop of 4·5 mm.

Case 8.—A woman who had two children and had had two miscarriages. Typical rheumatoid picture, with a lag type of glucose tolerance test. She did not have sulphur water or sulphur baths, and she was very debilitated. She had 3 injections of solganol. In spite of slight increase in weight she gave no other signs of improvement and I considered that she would become a chronic invalid. Later I had a talk with her doctor and discovered that her home conditions were bad; she lived in an isolated farmhouse in a bleak spot on the moors and her husband was an uncouth bullying type of man. This no doubt accounts for the bad prognosis.

Case 11.—A woman who had had two children and a self-induced abortion. Typical rheumatoid; hands, feet and knees involved. She had sulphur water and magnesia water to drink and sulphur baths, Berthollet steam-baths, wax and massage. She made great strides during the twenty-six days in hospital, in every way, but her sedimentation rate was much worse and I think she will relapse in due course.

Case 23.—A woman who had had eight children and a five years' history of typical rheumatoid arthritis involving hands, knees, feet, shoulders and elbows. She had sulphur and magnesia waters to drink and sulphur baths, Berthollet steam baths, radiant heat, massage and ferri et ammon. cit. mixture as her hæmoglobin was only 65%. She did not improve clinically and she lost 5½ lb. in weight, yet her sedimentation rate showed the biggest drop in the whole series.

Turning now to the second group. All these patients had 100 grammes of glucose a day, in addition to the ordinary hospital diet, for a fortnight, beginning after they had been in hospital five days. This was in order to see if glucose would make the rheumatism worse and if it would have any effect on the sedimentation rate. I realize that the series is too small to allow of any conclusions being drawn, but comparing this group with the previous one some interesting points arise. Only four out of 11 showed improvement in the sedimentation rate at the end of their stay—giving 36% as against 76%—yet the average stay in hospital was eight days longer. In addition, seven cases were definitely worse clinically during the time they were taking glucose, especially during the second week. They had more pain and in most cases the active joints were more swollen. Only one of these (Case 20) showed any improvement in sedimentation rate, and that only slight. In this series Dr. Collins carried out more than two estimations and we noticed that during the first week of glucose ingestion the rate remained the same or tended to improve, but after that began to go up. This lag, I think, accounts for the relatively poor percentage in this group, because the clinical improvement at the end was just as good as in the first group.

Three cases which showed improvement are worthy of more detailed notes :—

Case 13.—This may eventually prove to be a case of true focal arthritis, for though the joint lesions were typical of the rheumatoid type the patient had had her tonsils and septic teeth removed three months before admission and was beginning to improve, and during her stay in hospital the hæmoglobin rose from 76% to 98%.

Case 19.—This patient's trouble began after the birth of her last child twelve years ago. She has spondylitis in addition to lesions in her hands and feet. She has been in hospital before and always does well but relapses soon after discharge.

Case 25.—A child who, in addition to the joint lesions, has a mitral lesion, so that this may be a case of subacute rheumatic fever. The mother is a rheumatic cripple. The child improved throughout the time, and no doubt, at her age, the glucose had a beneficial effect.

To summarize: Though I quite realize that the series of cases is too small a basis for definite conclusions, I think it is interesting to note that the percentage of improvement by physical methods, as indicated by the sedimentation rate, compares favourably with the figures obtained by other methods of treatment, especially when the length of time is taken into account.

Glucose has a definitely harmful effect both clinically and as shown by the sedimentation rate.

Section of Otology

President—F. J. CLEMINSON, M.Chir.

[*December* 3, 1937]

DISCUSSION ON THE OPERATIVE TREATMENT OF CHRONIC MASTOID DISEASE

Mr. Somerville Hastings: Mastoid operations may be classified according to (1) what is removed, and (2) what is done with the resulting cavity in the temporal bone.

The objects of operation in order of importance are to make the patient safe by reducing his liability to intracranial complications, to retain, and if possible improve, his power of hearing, to rid him of an unpleasant and troublesome discharge and to leave, at the conclusion of operative treatment, as little deformity as possible.

(1) To attain these ends, and in particular the retention of hearing power, the less we interfere with the middle ear the better. Experience shows that removal of the incus does little harm to the hearing capacity, but that interference with the mucous membrane covering the round and oval windows is likely to result in considerable deterioration of hearing. Moreover, the decrease in hearing capacity is not infrequently progressive (C. H. Smith [1]), particularly in those cases in which there has been a good deal of interference with the middle ear in the course of a radical mastoid. Where therefore, a considerable portion of the membrana tympani can be left in situ to protect the mucous membrane of the inner wall of the middle ear, the best results from the hearing point of view are likely to be obtained.

It is generally agreed that, if the mastoid is dealt with by operation, every cell which might possibly be diseased and which can be dealt with without undue risk of injury to important structures should be freely opened. What else may be removed is indicated in the following table :—

Removed	Left in situ	Nomenclature
(1) Nothing, except mastoid cells.	Posterior bony wall of meatus, "bridge" outer attic wall, membrana tympani and ossicles.	*Simple* or cortical mastoid, associated with the name of Schwartze.
(2) Outer wall of attic, sometimes posterior bony wall of meatus, occasionally incus.	"Bridge", membrana tympani and ossicles.	*Conservative* mastoid, associated with the name of Küster, Zampal, and Charles Heath.
(3) Outer wall of attic, "bridge", posterior bony wall of meatus. Sometimes incus and rarely head of malleus.	Membrana tympani, usually ossicles.	*Attico-antrotomy* or modified radical mastoid, associated with the names of Siebenman, Bondy, &c.
(4) Outer wall of attic, posterior bony wall of meatus, "bridge", membrana tympani and ossicles.	Nothing.	*Radical* mastoid, sometimes associated with the name of Stacke.

In the first two of the above groups the tympanic ring with the attachment of the remains of the membrana tympani to it is left intact, but it is divided in the last two. The outer attic wall is removed in all but the simple mastoid operation. It is, however, doubtful how completely the outer attic wall was removed by Charles Heath [2] and the other surgeons who first described the conservative mastoid operation. Unfortunately the nomenclature is not yet unanimously agreed upon, the simple mastoid being occasionally described as the conservative, and the conservative sometimes as the modified radical.

In this paper I propose to speak of the four types of operation as the simple mastoid, conservative mastoid, attico-antrotomy, and radical mastoid.

(2) Before discussing these various operations, I will refer briefly to the methods of dealing with the resulting cavity formed by the opening-up of the mastoid antrum and cells. It may be allowed to granulate with or without secondary suture, or allowed to fill with blood-clot, or its obliteration may be undertaken by flaps of muscle or periosteum, or even some foreign substance such as B.I.P. In all but the simple operation, the mastoid cavity may be made to communicate with the external ear by some form of meatal flap and the mastoid grafted (together with the middle ear in the radical), either at the time of operation or later.

In cases in which no meatal flap is cut (for the most part subacute cases) I generally close the wound, except for the lowest half-inch, and pack the mastoid cavity with gauze, which I change every second or third day, so that the wound granulates from above down. When I am in any doubt as to the condition of the meninges or lateral sinus, I am accustomed to leave the wound open and undertake secondary suture as soon as the middle ear has been shut off by granulations, and the results have been so satisfactory that I am adopting this method in an increasing number of cases.

A detached muscle-graft from the rectus femoris or other muscle has been used, or a pedicled graft from the sternomastoid or temporal muscle. Kisch [3], who reports on the advantages of the temporal muscle-flap for the radical mastoid operation, and also attico-antrotomy, states that healing is usually complete in six weeks in radical cases. A periosteal flap has been used especially by G. J. Jenkins [4] in this country, who has advised that a special strip should be pushed into the attic and Eustachian tube after the radical operation. O. Popper [5] records the use of this method in 33 cases in children.

I cannot recall having filled the mastoid cavity with B.I.P. or other antiseptic substance, though I have often had occasion to remove these.

There is a tendency to take the view that the more exactly we leave the external auditory meatus at the close of operation, as we found it, the better, and to attain this end muscle and periosteal grafts are extensively used in all types of mastoid operation. With this I entirely disagree. To avoid an ugly depressed scar behind the ear after a simple or cortical mastoid, a periosteal or muscle-graft may have certain advantages, but for all other cases a meatal flap is, in my opinion, much to be preferred. The cosmetic disadvantages of a much enlarged external auditory meatus can be avoided if a properly planned flap is cut. I am accustomed to use the greater part of the posterior wall of the meatus as a flap which I bend upwards and retain in position by a very thin rubber tube in all mastoid operations, except the simple, and Mygind [6] gives it as his opinion that relapses are less common after the radical operation when plastic meatal flaps are used, and suggests that the plasticless radical operation should be abandoned. I am strongly in favour of the use of a meatal flap, as it makes the after-treatment on which ultimate success so largely depends, very much easier. Moreover, it is terribly easy to end up with a contracted meatus when no flap is used, and this is also possible if the flap is of insufficient size or badly planned.

It is sometimes said that the cavity left as the result of a meatal-flap operation interferes with the power of hearing, but I know of no evidence for this statement.

A much more real objection, which applies to all meatal-flap operations, is that a cavity partly lined by scar epithelium is left, and that in this cavity epithelial debris and wax slowly collect and have to be removed at increasing intervals. Where the patient is told of this at operation and has sufficient intelligence, either to have his ear attended to regularly or keep the ear clean himself, no difficulties arise, but when the ear is neglected, ulceration may take place beneath the debris and discharge recur. This in my opinion is the main, if not indeed the sole, objection to the flap operation.

My experience of Thiersch grafting has been, I regret to say, very limited, but those who practise it say that it is suitable for most cases except those with an exposed facial nerve or labyrinthitis (D. S. Cunning [7]).

Types of Operation

The Simple Mastoid.—Turning next to the various mastoid operations and the indications for each, there can be no doubt that the simple mastoid, when it can be used, gives the best all-round result. It is obviously unsuitable when there is attic disease or cholesteatoma, or a very small or contracted meatus. It has no advantages when the hearing is completely destroyed, or there is caries of the posterior meatal wall. It is, in my opinion, the operation of choice for those cases in which, without marked changes in the middle ear, the hearing is slowly deteriorating as the result of definite, and perhaps increasing, bone destruction in the mastoid, as shown by the X-ray picture. It is, therefore, the best operation for relatively early cases of chronic mastoid disease. It has been pointed out that in many of these cases resolution can be accelerated by the enlargement of a small perforation of the membrana tympani at the time of operation, but I am afraid I have not taken advantage of this suggestion as often as I ought. I have had two or three cases in which the lower half of the membrana tympani has been completely destroyed, and the ear has dried up rapidly and completely after a simple mastoid.

The Conservative Mastoid.—Two essentially different operations are included under the heading of conservative mastoid. In both, the outer attic wall is removed by cutting away bone either from within out (H. B. Blackwell [8]), or from without in (Voss [9]), but while in one the posterior bony wall is left intact, in the other it is completely removed and a posterior meatal flap is cut. Except that the removal of the outer attic wall makes it easier to be certain that the zygomatic mastoid cells are properly opened up, the first type (in which the posterior bony wall is left) appears to me to have no advantage over the simple mastoid. It is obviously unsuited for cases with a marginal perforation or any appreciable destruction of bone, and for such cases the simple operation is equally useful.

Where, however, the greater part of the posterior bony wall of the meatus is removed and the mastoid antrum thrown into a common cavity with the meatus, the conservative operation has, in my opinion, many and great advantages over the simple mastoid. In the first place the posterior meatal and zygomatic cells can be much more certainly exposed by it. Moreover, it is particularly useful when there is caries of the posterior meatal wall, where the meatus is contracted whether as a result of a previous mastoid operation, exostoses or other conditions, and where, after a simple mastoid, the posterior wound will not heal, because the aditus fails to be shut off by granulations. It has the advantage that the posterior wound almost invariably heals by first intention—so that bandages can be left off within a fortnight—and,

particularly, that the membrana tympani, aditus, attic, and antrum can be dealt with readily both at operation and at any time during healing—this, to my mind, is the greatest of its many advantages. Its only disadvantage is that a cavity is left in which ulceration may take place in an unintelligent individual. Where the opening in the tympanic membrane is thought to be too small for free drainage, it can be enlarged. I have used this operation extensively since I was first shown how to do it by Mr. Charles Heath [2] nearly thirty years ago, and am satisfied that it is still of value.

Attico-antrotomy.—In attico-antrotomy not only is the posterior bony wall of the meatus removed, but the "bridge" as well, so that the membrana tympani, or so much of it as remains, is unsupported and unattached to the tympanic ring in its upper and posterior aspect. It is often necessary also to remove the incus and occasionally even the head of the malleus. This operation is replacing the radical mastoid in an increasing number of cases. Its chief advantage is that since the middle ear is but little interfered with, the hearing is in many cases unaffected and sometimes even improved. It is especially indicated in an individual with ear discharge—which may have lasted a long time, and with an attic or posterior marginal perforation—and who has fairly good hearing in the affected ear. More especially should this operation be considered if the hearing on the other side is bad.

What are its principal contra-indications? I have carried out this operation a good many times in the presence of cholesteatoma and so far have had no occasion to regret it, and this would appear to be the general experience of surgeons.

To what extent is this operation justified in the presence of intracranial or other complications? Where there is no perception of hearing on the affected side there can be no possible advantage in an attico-antrotomy, nor would I perform this operation in those rare cases (if they exist at all) in which a partially dead labyrinth is indicated by the caloric or other test, while some power of hearing remains. A labyrinthine fistula is also, in my opinion, a definite contra-indication, as is also facial paralysis.

When, however, the labyrinth appears healthy and the hearing on the affected side is of some value, I do not think that the existence of a cerebral or cerebellar abscess or lateral sinus thrombosis make the indications for a radical mastoid imperative, especially if the hearing on the other side is very defective.

The Radical Mastoid.—Very little need be said about the *radical mastoid.* It is the operation we all do in the worst cases, when for instance there is little power of hearing, and the middle ear is much disorganized. It is also the operation of choice when there is a labyrinthine fistula or facial paralysis due to direct extension of inflammation. In tuberculous disease of the middle ear a radical mastoid will usually be required. While a radical mastoid will undoubtedly make a patient much safer, as far as intracranial complications are concerned, it does not always clear up the discharge. Moreover, the possibility of danger to the facial nerve, and of decreased power of hearing which may be progressive, have to be taken into account. It is especially on account of this last that the operation should be avoided whenever possible in children and young adults.

What should be done to the Eustachian tube in a radical mastoid? Should the mucous membrane be tucked in, in the form of a plug? (Kisch [3].) Should the opening of the tube be curetted, or should it be left alone?

Blackwell [8] has suggested that the mucous membrane of the tube may grow out through the enlarged orifice after curettage and lead to a continuance of discharge. Personally, I am accustomed to curette the tube, but in some cases my curettage has not secured the desired result, and the tube has remained open. On one occasion I apparently pushed my curette into the internal carotid artery, for on its removal a

jet of arterial blood shot half-way across the operating theatre. The bleeding was, however, stopped by tight plugging, and the patient fortunately made an uninterrupted recovery.

Douglas Guthrie [10] states that in his view the radical mastoid should not be performed in those aged under 12, save in the presence of cholesteatoma, intracranial complications, and tuberculosis of the ear. He says that on account of the difficulty of closing the Eustachian tube, the middle ear becomes repeatedly reinfected and filled with granulations and the hearing greatly impaired, and my own experience, though much more limited, confirms this. Guthrie prefers the simple mastoid for children, or if this fails, attico-antrotomy.

To sum up: When the hearing is fair and the perforation central, a simple or conservative operation is indicated, the simple in the relatively early cases, and the conservative (with removal of the posterior bony wall) in the later cases and in those with meatal changes. Where the perforation is marginal and the hearing good, an attico-antrotomy should be the operation of choice, but if the hearing is lost, it has no advantage over the radical mastoid.

In conclusion it may be useful to inquire what can be learned statistically about the results of the various types of mastoid operation. Such results are, however, in no sense comparable, because we are not comparing like with like, since every surgeon selects his cases, reserving the radical operation for those in which there is the greatest destruction of middle ear and usually also the greatest loss of hearing. Moreover, the statistics of different surgeons for the same operation are not always comparable, for with some, the criterion is the surgeon's own observations, and with others, the patient's statements.

Howarth and Bateman [11] in a recent and valuable contribution, report 43% of dry ears in 83 conservative mastoids. It is to be noted, however, that these were from cases of chronic otorrhœa requiring operation taken almost entirely without selection.

In earlier reports from the Royal Infirmary, Edinburgh, conservative mastoids and attico-antrotomies were grouped together. But since 1928, 37 operations of attico-antrotomy have been performed, and these are analysed by Bernard Carter [12]. A dry ear is reported in 65% of cases, improved hearing 43%, hearing unchanged in 35%, and worse in 22%. The results of 44 cases under the charge of Mr. J. D. Lithgow between 1933 and 1936 are recorded by J. F. Birrell [13] with 82% of dry ears. J. Jessen of Copenhagen [14], reports the results of 71 attico-antrotomies (with a dry ear in 58%), hearing improved in 40%; unchanged in 26%; and worse in 26%.

Turning now to the results of the radical operation: J. S. Fraser [15], in an analysis of 422 cases, gives 42% of dry ears with a higher percentage in grafted cases. J. Jessen of Copenhagen [14] reports 32% of dry ears, and L. White Junr. [16] 57%, and approximately the same percentage whether the ear was grafted at the time of operation, later, or not at all. As regards hearing capacity, J. S. Fraser's cases between 1919 and 1928 [17] show

	Improvement	No change	Worse
In grafted cases ..	72%	14%	14%
In non-grafted cases ..	64%	10%	25%

J. J. Pressman [18] as the result of analysis of 372 cases

	35%	18%	47%

I am indebted to my colleagues, Mr. F. J. Cleminson and Mr. C. P. Wilson, for permission to make use of the records of all cases of chronic otorrhœa dealt with by mastoid operation at the Middlesex Hospital, during the last seven years. With the help of the Registrar, Mr. D. W. Ashcroft, I have tried to get in touch with all the 163 cases, but have not been entirely successful. Our results, together with those recorded by other surgeons as far as discharge and hearing capacity are concerned, may be summarized in the following table :—

Operation	Reporter	Ears dry	Hearing			
			Better	Unchanged	Worse	
		%	%	%	%	
Simple mastoid ...	Middlesex cases ...	75	50	38	12	
Conservative mastoid	Howarth and Bateman	43	—	—	—	
	Middlesex cases ...	65	34	—	66	
Attico-antrotomy ..	Bernard Carter ...	65	43	35	22	
	J. F. Birrell	82	—	—	—	
	J. Jessen	58	40	26	26	
	Middlesex cases ...	25	12	50	38	
Radical mastoid ...	J. S. Fraser	42	72	14	14	grafted
		—	64	11	25	non-grafted
	J. Jessen	32	—	—	—	
	L. White, Junr. ...	57	—	—	—	
	J. J. Pressman ...	—	35	18	47	
	Middlesex cases ...	46	31	38	31	

As regards results in children, Guthrie [19] in 1926 gave 67% of dry ears in simple mastoids, 62% in attico-antrotomy, 52% in radical mastoids, and N. Asherson [20] in 1932 reported 50% of dry ears in attico-antrotomies, and 54% in radical mastoids. Asherson's figures indicate also that the former operation gives a slightly better result as regards hearing.

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Dr. Gavin Young: The principal motive in operating is the removal of the potential danger to life. Secondary only to this potential danger is the deterioration, progressive even if slow, in the hearing, and the operation is undertaken to prevent further deterioration; sometimes, happily, it results in improvement in the hearing. Other reasons for operating are discharge which may be copious or malodorous or both, the incidence of facial paralysis in a chronic case, or vertigo. The patient may give a history of periodic bouts of mastoid pain or of homolateral headache, and these are often synchronous with either a temporary lessening, or a marked increase, of the discharge.

Personally I was taught that the completed mastoid operation, in the chronic case, of course, should leave the whole area—middle ear, aditus, and mastoid cavity—under the eye of the aurist, capable of direct inspection for the rest of the patient's life, and that only so could safety be assured. After trial and, as I think, error, I see no reason for departing from the essentials of this early teaching, and accordingly I now confine my surgical procedure to two types of operation, the radical, and the anomalously-named "modified radical". By the latter term is meant the technique by which the mastoid cavity is exenterated, the bridge very carefully broken down—the last part of the breaking-down being done from within the aditus outwards by a sharp spoon, and the posterior part of the external attic wall being removed, the utmost care being taken to preserve intact *all* the normal intratympanic structures. From time to time, reference is made in the literature of mastoid surgery, to the fairly casual removal of the incus. The incus has been removed accidentally in two of my cases, in clearing a choked aditus, in cortical mastoid operations, but I have been unable to assure myself that the hearing acuity was not considerably lessened by the accident.

The main factor in deciding between the two types of operation is the patient's hearing, not merely in the affected ear, but also in the other ear. Where the hearing of the other ear is under normal, with the possibility of progressive deterioration, every care must be taken to conserve the hearing in the operated ear.

Consider the factors which affect sound-conduction in a damaged ear. The state of the tympanic membrane is of little importance. The absence of most of the membrana tensa, as in some post-scarlatinal cases, is not incompatible with the hearing of whispered speech up to twelve or fifteen feet, or more. On the other hand, the hearing may be very poor indeed in a case with a small perforation in Shrapnell's membrane. To carry the argument further, we may have, as in otosclerosis, an entirely normal drumhead, with extreme deafness.

Some years ago, a member of this Section drew attention to the interesting clinical fact, which I myself had already recognized, that marked deafness in a case of acute suppurative otitis media, with negative Rinne, is strongly suggestive of serious mastoid involvement. If this be accepted, why does the filling-up of the mastoid air-spaces so greatly increase the dullness of hearing? Is it because of the loss of the cavity as a resonating chamber? It is certainly true that chronic adhesive process and otosclerosis are usually accompanied by sclerosis of the mastoid process. On the other hand it is also true that the hearing after an uncomplicated cortical operation is usually practically perfect, that is, of course, in an acute case, and the mastoid process may have become rather a defective resonating chamber, being broken up by dense layers of fibrous tissue and deposits of new bone. It is, however, still a resonating chamber.

The other factor of importance is, of course, the integrity of the ossicular chain. We must ask ourselves whether it is essential that this chain be maintained intact at all costs, to preserve the hearing. In many cases, however, the chain has been broken before operation, and these need not be considered further. Members

have already been reminded of the type of case in which most of the membrana tensa has been destroyed and yet the patient has surprisingly good hearing. Similarly, after the radical operation, in some cases, the patient may hear whispered speech up to 15 feet or more. The integrity of the ossicular chain is not essential to reasonably good hearing. What *is* necessary, in my opinion, is the mobility of the stapes, and it must be the duty of the surgeon to clear this area of granulations, as far as possible, and to protect it for the future. This is best secured by exercising care, in lowering the facial ridge, not to remove any more of the ridge than is consistent with providing a roomy aditus and with not leaving too high a partition between the middle ear and the mastoid cavity. Other things being equal, the lower the bridge, the worse the hearing.

Every case should be examined radiographically, before operation. In many cases, of course, one learns little, the common report being that the mastoid process is sclerosed and is evidently the seat of chronic disease. If we could be sure that the sclerosis extended right up to the aditus, as it sometimes does, we might be able to avoid the mastoid operation, by repeated use of the intratympanic syringe, and ossiculectomy in the case of ossicular caries. I would be glad to learn of any means of differentiating radiographically between cholesteatoma and sclerosis.

An attic perforation, usually indicative of caries of an ossicle or of attic cholesteatoma, is an indication for the radical technique, unless the aurist is prepared to attend the patient periodically, with intratympanic syringing, up to the threshold of the grave. The speaker has come to the conclusion that unless certain exceptional circumstances exist, the presence of cholesteatoma demands as radical an operation as possible.

The presence of a polypus is not, *per se*, an indication for the mastoid operation. In a very fair proportion of these cases, careful removal of the polypus, with cauterization of the stump by nitrate of silver, is followed by drying-up of the discharge. Recurrence of the polyp, however, or continuance of the discharge, calls for operation which may be either radical or modified according to the findings. Care is taken to preserve the polypus intact in the meatus until the mastoid cavity is cleared, the posterior meatal wall broken down and the flap cut, when the point of origin of the polypus may be discerned. This is usually in the region of the tympanic ring, and not, in my experience, so often in the neighbourhood of the promontory as some statistics have indicated. The posterior wall is a common site. One often finds adhesions between the pedicle and the meatal wall.

Where there is complaint of vertigo, whether or not spontaneous nystagmus is present, the labyrinthine functional tests should be carried out. In a fair proportion of such cases, without nystagmus, no labyrinthine lesion is discernible and, especially in the elderly, the vertigo may be due to vascular changes in the labyrinth. The operation to be undertaken would depend upon the extent of the labyrinthine disorganization. Personally I incline to be conservative in dealing with the labyrinth.

In a case of chronic otorrhœa with facial paralysis, the type of operation will depend upon the site of the lesion in the nerve. In a sclerosed mastoid, without cholesteatoma, the lesion is likely to be intratympanic, and the radical operation is required.

Unless one is dealing with a cholesteatoma, or a case in which the labyrinth is dead, one sets out to perform the modified operation. The findings in the middle ear, after the flap has been cut, determine the final type of operation. In the Western Infirmary, during the two years 1934 and 1935, 150 cases of chronic mastoiditis were operated upon—117 by the radical method, and 33 by the modified. In 39 of the 117 cholesteatoma was present. On the whole our experience is that the hearing is not often deteriorated by the radical operation, and is quite commonly improved.

Mr. Walter Howarth said that in the paper which Mr. Bateman and himself had written they merely recorded their results during the last few years in order to discover, for their own benefit, the relative value of these operations. He did not intend to repeat those results now; but he wished to ask whether members of the Section could come to some conclusion as to nomenclature. What Mr. Hastings and he himself called the modified radical others called attico-antrotomy, and it would be helpful if some definite name was agreed upon for this and for other operations.

He also wished to ask those members who had had a large experience of the conservative mastoid operation, and who used it in a variety of cases, such as Mr. Mollison, whether they had been disappointed, as his colleague and himself had been, to find occasional cases, not selected cases, coming with symptoms six months after that operation and, when the operation cavity was reopened, to discover the serious condition of a little pocket beneath the dura in the roof of the attic.

Mr. L. Graham Brown said that in a paper published six years ago (*B.M.J.*, 1932 (i), 470) he had described his own technique of a modified radical mastoid operation, and at the December meeting of the Section in the same year he had shown a series of six such cases, in which the operation had been successful, from both the point of view of dryness of the ear and that of the preservation of hearing.

When he decided to operate in cases of chronic suppuration of the middle ear and mastoid he confined himself to three types of operation: (1) Simple mastoidectomy (or the Schwartze operation). (2) Modified radical mastoidectomy. (3) Complete radical mastoidectomy. The modified radical operation could be further explained as the transmastoid antro-atticotomy, because one approached the diseased area by way of the mastoid, first entering the antrum and thence proceeding into the attic. Removal of the ossicles might also be included in this type. If the incus was diseased he took it away, and then—for better drainage—he also removed the head of the malleus. One point in the operation which was perhaps not clear was with regard to the membranous meatus and tympanum. In selected cases, particularly those in which the greater part of the tympanic membrane remained, and which might include not only cases of attic perforations—in which the hearing was usually still very good—but also cases of postero-superior or postero-inferior marginal perforations, he interfered as little as possible with the membranous meatus and its attachment to the tympanic membrane. He made no flap, but carefully separated the lining membrane from the posterior bony wall of the meatus as far as its attachment with the tympanic membrane at the annulus tympanicus. He then chiselled down the posterior bony wall of the meatus, opened up the aditus, and removed the posterior portion of the outer attic wall. With the aid of a pair of spectacles (magnifying 1½ times) one could view the region of the attic, see the incus and the head of the malleus, and deal with any disease present, whether in the form of necrosed ossicles, debris, or granulations.

The complete radical operation he called the transmastoid antro-attico-tympanotomy. Here he made the smallest flap possible—namely the small triangular portion of the membranous meatus that covered the posterior bony wall of the meatus before its removal. He closed the wound posteriorly, and drained through the meatus with a large tube. In this way the size of the resultant middle-ear cavity was reduced and almost the original calibre of the membrano-cartilaginous meatus was maintained.

The simple, or Schwartze, operation was, he found, often sufficient in the case of young children, in whom for obvious reasons the radical operation should be avoided as often as possible. Even in adults he very rarely had to perform the radical operation. He reserved it for cases of labyrinthitis and for certain cases of petrositis,

extensive cholesteatoma, and middle-ear disease, especially when the hearing was already greatly reduced. The whole result of a mastoid operation depended on the post-operative treatment, and this should be carried out by the operator himself, or under his direct supervision. With regard to post-operative drainage, he would plead for the use of Southey's tubes, in a method which he found painless and highly satisfactory. The posterior wound could be completely closed and the cavity kept periodically irrigated with eusol through a pair of fine rubber tubes leading into it.

He suggested that some of the cases in which suppuration persisted after a most careful mastoid operation might be examples of chronic petrositis.

Mr. A. J. Wright said that the tympanum, if one excluded the attic, had very great powers of recovery, and should be handled gently. To secure the healing of a diseased mastoid cavity and attic one must drain and ventilate them, and for this purpose the meatus should always be enlarged. His own greatest difficulty was in preventing meatal contraction. He had tried various flap methods, but had not hitherto consistently used tubes.

It was a great mistake to try to obliterate cavities. That mistake was made many years ago in dealing with the frontal sinus, and it was a long time before it was appreciated that it was attempting not only the impossible, but the undesirable.

In many of the cases operated upon the wrong part of the body received attention. It was seldom in cases with an inferior perforation that surgery was needed on the mastoid process ; in nearly all of these attention to the other end of the Eustachian tube would result in the clearing-up of the infection in the ear, and what was most often neglected was attention to the mouth. The surgeon's outlook so often began in the nasopharynx and nose that he forgot that infection in the teeth might perpetuate infection in the middle ear.

These impressions were based, broadly, on nine years' experience, during which time he had not performed the radical mastoid operation.

Mr. A. G. Wells said that he had performed about 2,000 mastoid operations of all kinds on children. His results with muscle-grafts had varied considerably. Some had involved reopening in spite of the fact that the greatest care had been taken in opening up the cells. Skin-grafting had been generally successful. It was best after operation on children to use a fine rubber glove with holes in, packed with wool. The greatest success he had had in children had been with the conservative operation. Between 1919 and 1920 he had performed over 200 operations of the conservative type ; in 1919 his successes were between 80% and 90% ; in 1920 they were over 90%. He had carried out all the after-treatment himself, and that had made a great difference. This was shown in subsequent years, when circumstances were such as to make it impossible for him to undertake the after-treatment, and then the percentage of successes showed a material fall. He used a flap whenever possible ; in all the conservative cases he had made a flap.

Mr. F. W. Watkyn-Thomas said that the radical mastoid was not always needed for cases of fistula, especially when the fistula was into the external canal. Sometimes all that was necessary was attico-antrotomy, or even an extended Schwartze operation. His experience of the flapless operation had been discouraging. Some years ago he did a series with no flap, and it was nearly always necessary to convert them afterwards into the radical, or to do a plastic operation in order to open

up a pocket. During the last ten years he had never performed radical operations on children except in cases of suppurative labyrinthitis, when it was necessary to reach the promontory. It was as easy to carry out attico-antrotomy in a child as in an adult, for the tympanic structures were nearly as large. In a certain number of cases one could close the Eustachian tube if there was no recurrent infection in the naso-pharynx, but in these cases there was no need to do so. If there was recurrent tubal infection he did not believe that closure was possible.

Mr. Michael Vlasto said that the operation of flap-cutting after a radical mastoid was rather irksome. He asked how Mr. Graham Brown obtained sufficient pressure on his small deep flap without including the cartilage in his incision. He drew attention to a treatment, much in vogue on the Continent, for post-mastoid sepsis by douching the suppurating area with ozone.

Mr. Graham Brown (in reply) said that he dealt only with the membranous portion, not with the cartilaginous. He made a slit upwards with a small knife, and another outwards to form a triangular flap. There resulted a little tongue of membrane which could be pushed backwards into the region of the antral cavity. In the adult one could use a tube almost the size of the little finger. The tube had to be inserted in a particular way, namely over a pair of artery forceps which gripped and narrowed the end that was being inserted, and were used to force the tube down as far as the antral cavity. He removed the tube at the end of forty-eight hours, and used ribbon gauze packing instead.

Mr. W. S. Thacker Neville asked what was the late sequel of cases of simple mastoid operation. Poor patients relapsed at times, and returned to hospital; well-to-do patients either did not relapse, or went to other surgeons. Malnutrition probably accounted for the relapses in the hospital patients. When such patients returned, the mastoid was found sometimes to consist of one large cell full of pus, covered by a scale of bone. How could that condition be avoided?

He himself had begun by treating the cavities with bipp, and closing the wound. He then rejected that method, and used two-hourly irrigation through a fine rubber tube—as in Dakin's treatment for wounds during the Great War. He finally rejected that method also and reverted to packing the wound with a bipp plug which was removed a week later under anæsthesia. The cavity was painted with mercurochrome, 5% in 50% alcohol, and exposed to the ultra-violet rays, or treated by daily zinc ionization. Two weeks later a pedicled muscle flap was used to fill the wound, and a week afterwards the wound was sutured and the patient was discharged. Thus the whole treatment lasted four weeks. Nowadays he practically never performed a radical mastoid operation.

Dr. Ewart Martin said he thought that the conservative mastoid operation should be the choice in acute cases, or in cases which were becoming subchronic. In chronic cases, where there was cholesteatoma or a mixed bacterial flora, proper drainage and ventilation must be obtained by a radical mastoid or an attico-antrotomy. A radical mastoid operation would rarely be necessary in a child if care was taken with regard to the original otitis.

Dr. E. E. Burnier said that since he used skin-grafting he had had little difficulty with mastoid operations. He made a cast of the mastoid cavity by using a layer of Tulle gras (Lumière) tightly packed in with gauze. The cast was carefully lifted from the cavity, placed on a sterile towel, papered over with the skin-graft, and replaced,

the end of the gauze coming out of the meatus and holding down the flap. On the fifth day the gauze and the Tulle gras were removed. No other treatment was needed except daily swabbing and dusting with iodized-boracic powder.

Mr. William Stewart said that he performed only two types of operation for mastoid infection—the cortical and the modified radical. He agreed that the only perforation of the drum calling for a mastoid operation was a postero-superior one. He cut flaps and packed them in position with iodoform gauze. Three days later this gauze was removed under nitrous-oxide anæsthesia. No further packing was done, indeed the ear was not even examined for two weeks. Packing, with the insertion of drainage tubes, was quite unnecessary and inflicted needless pain on the patient. Packing and even swabbing out the cavity interfered with healing and stimulated the deposition of fibrous tissue.

Illustrative Cases

Four Cases of Radical Mastoid Operation followed by Gradual Improvement in Hearing.—Terence Cawthorne.

I.—Mr. N. R.

31.10.32 : Right radical mastoid for acute flare-up of long-standing chronic otitis, with subperiosteal abscess. Full of cholesteatoma. Wound left open at operation and closed three weeks later. No skin-graft. Cavity dry in four months. Since then seen twice a year for removal of debris. Occasionally moisture from Eustachian tube.

Hearing—	Voice	Whisper
Before operation	6 inches	Not heard
15.9.33 ...	8 feet	3 feet
14.10.37 ...	25 feet	18 feet

II.—Mrs. L. C.

10.9.32 : Right radical mastoid for acute flare-up of long-standing chronic otitis. Acellular bone with cholesteatoma. No skin-graft. Cavity dry in three months. Occasional moisture since then.

Hearing—	Voice	Whisper
Before operation	Very deaf	
16.2.34 ...	13 feet	6 feet
23.3.37 ...	16 feet	10 feet
28.9.37 ...	20 feet	18 feet

III.—Mr. J. L.

1.8.34 : Right radical mastoid for long-standing chronic suppuration with cholesteatoma and granulations. Skin-graft two weeks later. Ear dry in one month.

Hearing—	Voice	Whisper
Before operation	6 inches	6 inches
2.10.34 ...	4 feet	2 feet
8.2.35 ...	18 feet	4 feet
24.9.37 ...	18 feet	10 feet

IV.—Miss G. N.

Right radical mastoid fifteen years previously. First seen seven years ago when cavity was full of debris and there were granulations on the inner tympanic wall. Cavity dry in three weeks. Return of discharge May 1937. Responded to treatment in five weeks.

Hearing—	Voice	Whisper
Before operation	No record available	
21.5.32 ...	8 feet	2 feet
2.12.37 ...	20 feet	12 feet

These four cases are shown to demonstrate that gradual improvement of hearing actually may occur after a radical mastoid operation. In only one was a skin-graft applied to the cavity, and in that case the piece of graft over the inner tympanic wall did not take. In no case is there a skin-graft on the inner tympanic wall. It may be that rapid healing with a minimum of fibrous tissue around the foramen ovale contributes not a little to the good hearing in these cases, which, although unusual, are not the only cases in my experience.

Bilateral Chronic Suppurative Otitis Media. Acute Serous Labyrinthitis of Right Ear. Radical Mastoid Operation in Quiescent Stage. Modified Radical Operation Left Ear.—L. GRAHAM BROWN.

Male, aged 32, first seen July 13, 1934, complaining of discharge from both ears since the age of 5 years, following scarlet fever. Five weeks previously he had had symptoms of acute labyrinthitis which compelled him to remain in bed three or four weeks.

On examination the right ear showed chronic suppurative otitis, with gross destruction of the tympanic membrane and granulations present in the middle ear. Slight spontaneous nystagmus could still be elicited on looking towards the left. The deafness of the right ear was nearly total.

The left middle ear also showed chronic suppurative otitis with a marginal perforation in the infero-posterior segment. The hearing in this ear was good.

In view of the definite labyrinthine attack of the right ear a complete radical operation on this ear was performed on August 14, 1934.

On March 3, 1936, the patient came again for advice, this time regarding his left ear. On examination discharge was still present and there were signs of retention of pus in the antral region. A modified radical operation was advised (antro-atticotomy) and carried out on June 29, 1936. The incus was necrosed, and was therefore removed, as also was the head of the malleus. Hearing in this ear remains good.

Chronic Suppurative Otitis Media. Modified Radical Operation.—L. GRAHAM BROWN.

Female, aged 25, seen 1.11.37, complaining of discharge from the left ear for four years. Five weeks previously she had had an attack of vertigo and vomiting accompanied by fever. On examination the left ear showed chronic suppurative otitis media, with granulations at the site of a postero-inferior marginal perforation.

The left labyrinth was active to the cold caloric test and the hearing in the left ear was good.

Operation (10.11.37).—Transmastoid antro-attictomy. The ossicles, being found

intact, were left in place. The patient was discharged from hospital, 29.11.37 with the wound healed, the middle ear dry, and the hearing very good.

Mr. GRAHAM BROWN said that in the first of these two cases, operated upon radically, he had used the method which he had described, passing a tube in through the meatus. He had not interfered at all with the cartilaginous meatus; had he done so there would certainly have been cicatrization, which would have led to stenosis of the meatus.

In the other case the ossicles, being healthy, were left in position. The result was that the patient still had acute hearing. He looked upon the tympanic membrane and the chain of ossicles with their muscular attachments as an accommodating mechanism whereby optimum conditions could be created for the transmission of sound vibrations through the labyrinth to the organ of Corti. Therefore the aim of his operation was to restore anatomically as far as possible—and consistently with the removal of disease—normal conditions to the tympanic cavity.

Section of Dermatology

President—H. HALDIN-DAVIS, F.R.C.S.

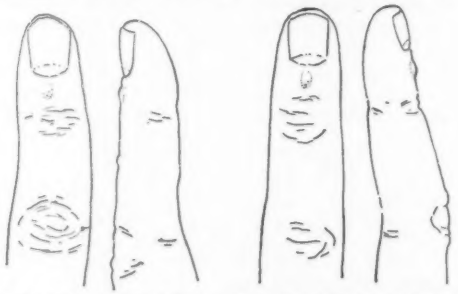
[*December* 16, 1937]

A Case of So-called "Synovial Lesions".—F. PARKES WEBER, M.D., and W. FREUDENTHAL, M.D.

The patient, G. H., aged 76 years, in fair general health, had noticed during the last two or three years a little raised nodule in the skin over the dorsum of the terminal segment of two of his fingers. They were situated between the interphalangeal joint and the nail-root. One was on the left index-finger, a few millimetres in diameter, pinkish in colour, and had never been tender or painful. The other was on the right middle finger, paler and slightly smaller, and had given rise to considerable local pain, especially when it had been knocked; an attack of pain might last a few days before it gradually disappeared. The possibility of glomus tumour (Masson) was thought of on account of the pain and the position of the lesions.

These nodules were excised in April 1937 by Mr. A. Compton, who kindly furnished the accompanying diagram, showing their position on the fingers.

Two biopsies were performed. The first lesion, from the left index finger, shows a large oval cyst which occupies two-thirds of the cutis and which has bulged the overlying skin. The cyst is lined in most places with one to three rows of endothelial



Left index finger, dorsal and lateral views. Right middle finger, dorsal and lateral views.

cells, and is filled with faintly staining fine granular masses, forming a network. Underneath the large cyst can be seen a much smaller oval area, in which the sole difference from the surrounding connective tissue is the rarefication of the connective tissue fibrils. There is no sign of inflammation or of any tumour formation.

The second lesion, from the right middle finger, shows two cysts. The left one represents the connecting link between the fully developed cyst and the earliest stage in the first section. The area here is larger and better defined than in the earliest stage. Also the connective tissue bundles have further diminished and the space is occupied by star-shaped cells and fine fibrillary masses, the whole recalling the microscopical picture of Wharton's jelly in the umbilical cord. The other cyst is a fully developed one; it is partly surrounded by epidermis, and is apparently in the process of being eliminated.

According to a recently published paper by R. E. Gross (*Surg., Gyn., and Obst.*, 1937, **65**, 289), only 14 cases, including L. Savatard's two cases (*Arch. of Derm. and Syph.*, 1924, **9**, 441) are recorded. The pathogenesis of this condition is controversial, and will be discussed and published in full in the *British Journal of Dermatology*.

Discussion.—Dr. PARKES WEBER said he thought that Dr. Freudenthal had established the existence of a seventh kind of synovial cavity. There were indeed three kinds of normal

synovial cavity in the body (those of the joints, those of the tendon-sheaths and those of the normal bursæ) and four kinds of abnormal synovial cavities, namely, as found in: (1) False joints; (2) abnormal bursæ; (3) ganglia; (4) so-called synovial lesions. The abnormal synovial cavities were not necessarily entirely pathological, for they might be the result of physiological processes of repair and accommodation reacting on a trauma or some other harmful or irritating agent. Thus, after a fracture of a long bone, if reunion failed, Nature attempted to produce a false joint as the next best alternative to perfect healing. An abnormal bursa was probably usually a manifestation of Nature's defence against intermittent pressure or friction over a hard (usually bony) prominence.

A ganglion, though its most usual site was on the back of the wrist, might occur in many other situations, for instance, even in the palm of the hand. If a connexion could be traced with a joint-cavity, a ganglion was called a Baker's cyst, and in such cases evidence of local tuberculosis had apparently sometimes been found (though the pathological relation was not clear).

From the histological point of view all the seven kinds of synovial cavity probably originated in a similar way.

There was, he thought, no necessity to assume the survival of "rests" of undifferentiated mesenchymal tissue as the origin of abnormal bursæ, ganglia, or "synovial lesions".

Dr. A. C. ROXBURGH: I had two similar cases a few months ago and had never seen anything like them before. In one case I thought the lesion was a wart until I cut it open. I did not know what to do but I tried X-rays, one pastille; this, however, was of no use. Then I tried galvano-cauterization and that effected a cure. I treated the other patient by zinc ionization but I have not yet heard the result. [Dr. PARKES WEBER: What was the position of the lesions in those cases? Dr. ROXBURGH: Exactly that in the present case—i.e. between the terminal joint and the base of the nail but both the lesions were larger than those in this case.]

Dr. G. B. DOWLING: I remember three cases of this condition; the cyst in each was situated exactly in the position described by Dr. Parkes Weber. The first was treated with radium, without success. In the second the lesion had on several occasions broken down and discharged a mucoid fluid. I tried radium, again without success, and eventually the lesion was excised. In the third case also the lesion was excised.

Dr. HUGH GORDON said that he had seen three cases of this condition. In two the history had extended over five or six years and in both the cyst had broken down from time to time and discharged a glairy fluid and had then filled up again. Excision had apparently cured them. Injury was said to be responsible in the third case—that of a dentist who remembered having run a drill into his finger. The cyst was opened and carbolized. Two treatments had been necessary to effect a cure.

Dr. A. M. H. GRAY: A medical colleague of mine had two of these lesions on his finger. I treated them as Dr. Roxburgh did those in his cases, with X-rays—without any effect at all. He has recently told me that he had discovered a cure—namely the old-fashioned remedy of knocking them with a hammer.

Dr. GODFREY BAMBER: I have seen two of these cases. I think that before I saw the patient in the first case she had had treatment by X-rays and ionization. I tried excising the lesions but they recurred. Then I tried cauterization with carbolic. The patient went to live in Scotland, and I believe she is still in the hands of an Edinburgh dermatologist. In the second case the lesion was on the thumb. I opened it up and cauterized the place with carbolic. I have not seen the patient since.

Dr. PARKES WEBER (in reply) said he would like to say a word on the clinical side of the subject. In regard to Dr. Gray's squashing a synovial lesion: As such lesions were almost the same pathologically as ganglia, one could understand that a method of treating ganglia might be occasionally successful for synovial lesions.

A knuckle-pad, if it occurred over a distal instead of a proximal interphalangeal joint, might be easily mistaken for a synovial lesion (in the absence of microscopical examination).

A synovial lesion might apparently, in rare cases, develop over a bony Heberden's node.

Multiple Subcutaneous Phleboliths over the Tibiæ. — F. PARKES WEBER, M.D.

The patient, Mrs. M. H., aged 60, is a well-built woman who has habitually enjoyed good health. Recently she had some cardiac palpitation, and during a general examination very many minute hard nodules in the subcutaneous tissue over

both tibiæ were felt. X-ray pictures showed them to be calcareous, and I take them to be small phleboliths, though they are not all obviously connected with the dilated superficial veins in the legs, which can hardly be termed varicose veins. Radiographic examination likewise revealed the presence of early osteitis deformans (Paget), particularly of the skull, which showed the characteristic woolly appearance.

Blood-Wassermann reaction negative. Brachial blood-pressure 140/100 mm. Hg.

Phleboliths like these over the shins—if they really are phleboliths—are, I think, not very rare in elderly women. Such cases might perhaps be termed "local phlebolithic calcinosis".

Morbus Recklinghausen with Glomoid Tumours.—ROBERT KLABER, M.D.

A girl, aged 13. At the age of 3 months some brown spots were noticed on the trunk; these have been gradually increasing since in size, number, and depth of colour. More recently several blue spots have appeared. There is slight scoliosis which is said to have been first observed after she had pneumonia at the age of 7.

The patient now shows an enormous number of brown macules on the trunk and limbs, varying in size from that of a pin-head to 3 in. in diameter. On the front of the left wrist there is also a pigmented band which shows slight soft infiltration. In addition, she has soft blue nodules. There is a group of these blue nodules on the right side of the neck and similar solitary nodules are present on the left heel and calf which are tender to deep pressure.

A section of tissue removed from the left wrist showed the characteristic histological changes of Recklinghausen's disease. A blue nodule excised from the right calf showed histology closely resembling that of Masson's glomus tumour.

I have ventured to describe these nodules as "glomoid" because, in spite of this histological resemblance and clinical tenderness, several were present in situations where the glomus was not believed normally to occur.

Discussion.—Dr. PARKES WEBER said that he had often heard of bluish lesions and had sometimes seen them himself in Recklinghausen's neurofibromatosis, but he had never seen lesions so blue as some of those in the present case. He supposed the blueness of the excised nodule was due to the blood that it contained. Such lesions, if previously observed in Recklinghausen's disease, would certainly have been described as angiomata.

Dr. I. MUENDE said that he had had a similar case five years ago where a man aged about 45 who had had psoriasis for more than thirty years developed numerous blue angiomatous lesions chiefly on the limbs but also on the trunk. He had removed one of the lesions and in the absence of recent knowledge of the glomus tumour called it a "cavernous angioma".

Weidman and Wise had described a similar case (*Am. Arch. Derm. and Syph.*) but he was not convinced that the histology in that case, or in Dr. Klaber's and his own cases, showed any resemblance to that of Masson's tumour.

Tumour of Cheek: ? Nature.—A. C. ROXBURGH, M.D.

W. B., aged 49, a well-covered man.

History.—For some months there have been red blotches on the forehead, chin, and right cheek. These are dusky red, slightly raised, and slightly infiltrated, with smooth margins. They are not irritable. About one month ago a tumour began to develop on one of these blotches, on the right cheek near the angle of the mouth. On December 9 this measured 4 cm. by 3½ cm. projecting about 1 cm. (*see* photograph). it was reddish-brown in colour, painless, and not tender; the surface was smooth and the texture firm; there was no fluctuation. The growth appeared to be rather in the skin than in the substance of the cheek. Five teeth were removed three weeks ago but the tumour was by then "quite a good size". The only remaining teeth are 9 in the front of the lower jaw, and these are healthy. Hair is still growing on the tumour.

Wassermann and Sigma reactions negative.

Urine clear; acid; no albumin or sugar.

Nothing else of importance on body, no enlarged glands. No viscus palpable.

Family history.—One brother and two sisters died of tuberculosis—aged 21, 14, and 22, respectively—forty-six to thirty-five years ago. They all lived in the same house. Patient has had no contact with tuberculosis since, so far as is known. One brother died of secondary sarcoma of the lung following an injury to the knee, at the age of 28 thirty-one years ago.

Treatment with potassium iodide and mercury for one week has produced no improvement, in fact the growth has increased by about ½ cm. in diameter during the week.

Diagnosis.—? sarcoid. ? mycosis fungoides à tumeurs d'emblée. ? sarcoma.

Discussion.—Dr. DOWLING: On clinical grounds I should have little hesitation in regarding this as a case of what is usually called mycosis fungoides à tumeurs d'emblée. The main difficulty is to decide whether the title should be sarcoma or mycosis fungoides. It does not help very much to try to distinguish one from the other, either on clinical or pathological grounds. Their behaviour may be relatively benign or serious. I have one case in which tumours have been present for seven years in one area, with remissions following X-ray treatment. I showed another, with Dr. Freudenthal, in 1935.[1] In that case several tumours developed within a few months in various parts of the body. A section of one was apparently that of a sarcoma; in another, spindle-cells were mixed with other types, in places suggesting granulomatous tissue. The histological findings were regarded at the meeting as characteristic of mycosis fungoides.

These tumours melted away under X-ray treatment, but the disease pursued a malignant course. About six months later spontaneous fracture of the clavicle occurred, the result of a tumour in the bone. Later one testicle became much enlarged. The new tumours also responded well to X-rays. Eventually an intracranial tumour developed and the patient died.

Dr. H. W. BARBER.—Dr. Muende may remember a case which I referred to him some years ago—that of an elderly man, who had several nodules on the back, resembling those seen in Dr. Roxburgh's case. The nodules were surrounded by slightly raised firm lesions, recalling a circinate erythemato-urticarial eruption. I thought the diagnosis lay

[1] *Proceedings*, 1935, **28**, 1525.

between mycosis fungoides à tumeurs d'emblée and true sarcoma. The nodules responded to radium, and the other lesions disappeared, but fresh nodules arose. Severe sciatica developed, and may have been due to secondary deposits involving nerve-roots. Eventually the patient died. Dr. Muende thought, judging from the histopathology, that the case was one of mycosis fungoides.

Dr. MACCORMAC said that if the lesion on the forehead was of the same nature as the large tumour on the face, a section prepared from the lesion on the forehead could be stained for Altmann's granules. These were present in abundance in mycosis fungoides, but were absent or relatively few in sarcoma. This test would therefore serve to distinguish the two conditions.

Dr. ROBERT KLABER said that "mycosis fungoides à tumeurs d'emblée" was a most unfortunate term and should be abandoned. When sections taken from this condition were shown to a general pathologist they were always held to be from some variety of sarcomatosis. It might be debatable whether the tumours which appeared in ordinary mycosis fungoides could be separated from sarcoma. If, however, it was sought to separate these so-called "d'emblée" tumours, as an entity from a variety of other forms of sarcoma, the position could not be supported.

Dr. DOWLING: At the same time the tumour of mycosis fungoides is not to be distinguished histologically from the type of tumour under discussion.

The PRESIDENT: I think the tumour is a sarcoid but do not wish to press the point.

POSTSCRIPT (20.1.38).—*Report by Dr. Robert Klaber on section removed from large Tumour on Right Lower Cheek.*

"*Epithelium.*—For the most part flat; shows extensive vacuolation and some invasion by cells from the infiltrate in the corium.

Corium: Shows extensive dense infiltration, consisting of somewhat primitive lymphoid cells, and marked hyperplasia of the reticulo-endothelial system. In many areas the lymphoid cells are arranged in a manner suggesting the germinal follicles of lymph-glands. In addition to some epithelial invasion by this new formation, several striped-muscle bundles and sweat tubules also show marked invasion.

Opinion.—The appearances are those of such extreme hyperplasia that they must be regarded as representing a new growth of the reticulo-endothelial system. In the absence of any palpable lymph-glands or blood changes, the condition should be described as a reticulo-sarcoma (lymph-sarcoma). This may possibly be associated with similar changes in other deep-seated areas."

Blood-count normal (Dr. W. Brewer).

The tumour has flattened out completely under two weeks of high voltage X-ray treatment by Dr. Levitt. For a short time there were some palpable lymph-glands in the left upper deep cervical group but these subsided under further X-ray treatment.—[A. C. R.]

White Spot Disease.—GODFREY BAMBER, M.D.

Mrs. F. C., aged 55. The condition has given rise to no symptoms and the patient does not know for how long it has been present.

In the region of the neck and shoulders are groups of atrophic spots of about the size of a pea; most of these have a pearly shine, but some are slightly scaly and a few show pitting of the surface. The scaling and pitting are more evident in another group of spots in the left groin.

On histological examination of a piece taken from the groin, the whole lesion is seen to be slightly depressed and shows considerable hyperkeratosis. The epidermis is thinned and the papillary body is completely flattened. The connective tissue in the upper third of the cutis is sclerosed, with a great diminution of the elastic tissue. There is in various places a gap between the sclerosed tissue and the flattened papillary body.

Treatment by some endocrine extract has been suggested.

Discussion.—Dr. PARKES WEBER said he thought that the lesions in the left inguinal region represented a keloid-like sclerotic development in old striæ atrophicæ (striæ cutis distensæ).

Dr. ROBERT KLABER wondered whether Dr. Bamber attached any special significance to the presence of two small white lesions on the front of the left wrist. He would be interested to learn if the condition was to be regarded as a form of guttate scleroderma, and whether its possible relationship to lichen sclerosus and lichen albus had been considered.

Dr. BAMBER (in reply) said he could not agree that the lesions were just an exaggeration of the striæ on the thigh. The striæ were bilateral, whereas the lesions were unilateral and some of them cut across the striæ and looked like the lesions on the neck. He was not prepared to say what white spot disease was. It rather differed somewhat, from lichen sclerosus and lichen albus, in that the typical lesions were nearly always found in the region of the shoulder girdle.

Localized Myxœdema associated with Graves' Disease. — GODFREY BAMBER, M.D.

Miss M. S., aged 44, in October 1935 underwent partial thyroidectomy for toxic goitre. Swelling of the dorsa of the feet was noticed one year later, and when seen

Localized myxœdema associated with Graves' disease.

in May 1937 she had put on much weight and complained of feeling the cold, and of the excessive growth of hair on the legs. (The legs were always slightly more hairy than normal.)

On examination.—The legs, from the toes up to the knees, were swollen with a hard œdema (*see* photograph). The skin, especially over the shins and around the ankles, was much thickened by semitranslucent papules, some isolated and others aggregated into plaques. The legs were very hairy. The basal metabolic rate was —39.

When two biopsies were made a glairy fluid exuded from the cut surfaces.

Histological report by Dr. W. Freudenthal. First section, from an isolated papule on the right leg; alcohol fixation: The epidermis is thinned and the papillæ are almost completely flattened out. The papule is formed by an increase in the bulk of the cutis. Just below the epidermis is a comparatively unaltered strip of connective tissue. The upper half of the cutis stains a faint pink with hæmatoxylin and eosin and shows a fair number of newly formed capillaries and also some perivascular round-celled infiltration. Van Gieson's stain shows the connective tissue bundles to be separated by œdema, to be much broken up, and in part destroyed. Between the bundles are faintly yellow-stained fine granular masses and threads. An elastic stain shows a large number of very fine fibrils. A thionin stain for mucin shows that the fine granular masses which stain a faint yellow with van Gieson are distinctly metachromatic.

Second section (from a plaque on the left leg, fixed in sublimate and acetic acid): This shows a more advanced stage of the same changes in the connective tissue.

Discussion.—Dr. PARKES WEBER said that the case was undoubtedly an extreme example of so-called "local myxœdema" in Graves' disease—perhaps the most extreme example on record. Though such cases seemed never to occur in connexion with true myxœdema, he thought the term "local myxœdema" ought to be retained (at all events, in brackets) in order to facilitate references to the early literature on the subject.

Dr. GODFREY BAMBER: The patient said that before the onset of the toxic goitre the legs were slightly more than normally hairy, but in nothing like the present state.

I recently read of a case of this kind which occurred after excision of a portion of the thyroid gland. The patient in that case also had a much raised basal-metabolic rate. A second portion of the thyroid was excised but the only result was a spread of the lesions. They appeared not only on the legs but also on the hands and on the forehead.

Acne Necrotica.—LOUIS FORMAN, M.D.

M. B., male, aged 25 years. The condition has been present for two years.

There are characteristic scars seen along the hair margins, in the eyebrow regions, and on the cheeks, nose, and middle of the chest, and also early papulo-pustules and crusted papules. The skin is seborrhœic.

Dr. H. J. Parrish of the Wellcome Research Laboratory kindly examined the filtrate of the *Staphylococcus aureus* obtained by culture from the early lesions. He reported that the toxin was of the alpha type, was not very potent, and did not produce reactions of unusual type in the skin of a guinea-pig.

Microscopical examination of an early small papule showed ready necrosis, with abscess formation. There was a faintly staining area in the middle of the abscess.

? Poikilodermia. ? Chronic Atrophic Dermatitis: Case for Diagnosis.—LOUIS FORMAN, M.D.

Mrs. H. S., aged 51, gives a twenty-five years' history of rash on the neck and arms. She has had five children, all girls, of whom only the second is now alive :—

1	2	3	4	5
Died after appendicitis	Well, aged 30	Died aged 4/12, "with bad sores"	Died aged 8/12; poisoned thumb	Died aged 5 years after a "breaking out" on the leg

Twelve years ago, following the death of her husband with an ulcerated throat, she was treated with arsenic and mercury. The Wassermann reaction was one plus positive on one occasion during treatment.

On examination.—On the sides of the neck the skin is faintly scaling, with some

atrophy and some reticulate pigmentation. There is also some reticulate pigmentation and atrophy of the skin of the axillæ. The skin of the buttocks and thighs shows cigarette-paper atrophy ; it is slightly scaling and the superficial veins show through clearly. It is not attached to the underlying fascia, but is loose and easily pinched up. The skin of the fingers and the palms is bright red, shining, and atrophied. There is a suggestion of œdema of the skin of the palms. The dorsal aspect of the toes shows the same changes. On the legs small hypodermic nodules have appeared from time to time and become ulcerated.

There is no muscular weakness and the tendon reflexes are brisk.

The urine was examined by Dr. Ryffel and showed 101 mgm. of creatinin and 2 mgm. of creatin per 100 c.c. The latter amount was said to be negligible.

The patient has been treated with injections of novarsenobillon, with, I think, some improvement of the skin of the axillæ.

The changes in the skin of the neck are compatible with those described by Civatte as occurring in poikiloderma, but those on the buttocks and thighs correspond with those in the chronic atrophic dermatitis of Pick-Herxheimer. It has been suggested by Fuchs and Oppenheim that poikiloderma and Pick-Herxheimer disease are related.

The report of other cases shown at this meeting will be published in the next issue of the PROCEEDINGS *of the Section.*

Section for the Study of Disease in Children

President—T. TWISTINGTON HIGGINS, O.B.E., F.R.C.S.

[*November* 26, 1937]

Problems of Undulant Fever in Children

By C. HARDWICK

(ABSTRACT)

PUBLISHED series of cases of undulant fever show the rarity of the disease amongst children. An analysis of eight cases under the care of Dr. Donald Paterson shows the following features :—

The youngest was 6 years old, the oldest 14½ years, and only one was a girl.

An abrupt onset was the rule, though in adults an insidious onset is the more usual. The earliest symptoms were those of an infection of the upper respiratory tract. It was the persistence of the temperature which pointed to an infection which was not a common cold. Sweating was a prominent feature in two of the cases, fatigue was marked in one, none complained of joint pains ; in no case was there a rigor.

An enlarged spleen was found in one case ; otherwise physical examination was negative.

Agglutinations were positive to a titre of 1 : 500 or more. One case emphasized the importance of carrying the dilutions sufficiently far enough to detect a positive result in the presence of a pro-zone.

Skin tests were positive in all cases. An attempt was made to detect latent cases of undulant fever in the wards at the Hospital for Sick Children, Great Ormond Street, by the skin test, using a preparation of brucellin. Out of 60 cases tested, only two gave a positive result ; agglutinations in these were negative. A positive skin test by itself is not regarded as evidence of the disease.

Four theories have been put forward to explain the mildness and rarity of the disease among children :—

(1) Many cases are not recognized.

(2) The organisms are only mildly pathogenic to man.

(3) The disease amongst children is almost entirely milk-borne, and pasteurization, however inadequate, is probably effective in making the milk safe.

(4) A speculative theory put forward by Dietrich and Bonynge (1932). As in calves, the tissues in children have a biological immaturity which gives them an immunity.

Reference.—DIETRICH H., and BONYNGE, C. W. (1932), *J. Pediat.*, **1**, 46.

Discussion.—Dr. DONALD PATERSON said that some cases of undulant fever might be missed by pathologists who used only low dilutions of the patients' serum agglutinations. There might be a negative phase in the low dilutions, and it was only in high dilutions, on occasion, that agglutination occurred.

It was not fully realized that the agglutinating properties of the blood of a patient suffering from undulant fever appeared to be rapidly lost, and therefore the general incidence of this infection in the population was not obtainable.

Dr. C. W. VINING asked whether Dr. Hardwick could tell them what proportion of a control group of children gave positive agglutination tests.

He doubted the advisability of labelling a child suffering from a comparatively mild disorder which had 100% recovery rate, with the diagnosis of undulant fever and thought that such a name easily produced an unnecessary amount of parental anxiety.

Dr. A. G. SIGNY said that whilst it was true that zone agglutinations did occur in abortus fever and it was essential to take the titre to 1 : 5,000, yet this was not always the case and usually agglutination was given by all dilutions up to 1 : 1,000 or so. It was difficult to state definitely what constituted a suggestive or diagnostic titre, but in routine examination of many blood specimens in cases of pyrexia of unknown origin he had not come across any which agglutinated suspensions of *Brucella abortus* at higher titres than 1 : 25.

Colonel A. G. BIGGAM asked Dr. Hardwick whether, in view of the positive brucellin test found in certain of his control series of apparently healthy children, he considered this test to be sufficiently specific to allow of its employment as a method of diagnosis in Brucella infection. If so, did he consider it to be more helpful than the agglutination test when undulant fever was suspected?

Dr. C. R. LANE asked if any of the cases had shown relapses. A case that he had seen, in which *Br. abortus* had been isolated by blood culture about a week from the onset, the patient, a child aged 3 years, had had at least three relapses, being perfectly well in between each relapse and showing enlargement of the spleen in the original attack and in each relapse, but no enlargement during the intervals.

If this was at all common, it made the recognition of *Br. abortus* infection in children of more than academic importance, as a relapsing fever of this kind would be very alarming unless the cause was known.

Dr. SYBIL ROBINSON asked if petechiæ or any other hæmorrhages had occurred in any of the cases, and described a case in a girl aged 5 years in whom such manifestations proved a serious complication.

Dr. HARDWICK (in reply), said that an agglutination of 1 : 64 or higher was always indicative of the disease. Controls never gave agglutination higher than 1 : 25. The skin test by itself was not considered to be proof of the disease.

None of the cases in this series had shown any relapses ; it was possible for a child to appear to be perfectly well during the apyrexial periods. In no case had there been petechiæ or hæmorrhages.

Urticaria Pigmentosa.—R. T. BRAIN, M.D.

S. D., a girl aged 3 months, was noticed to have a pigmented eruption on the trunk at birth. Her parents were healthy and not blood related and the other children, a boy aged 6 and a girl aged 8, were normal. The mother had spent some years in India where she had suffered from malaria.

On examination.—Many brown, oval or round, macular lesions were seen on the trunk ; some of these had small papules set in the pigmented spot and the papules were rounded and firm like those of papular urticaria. Otherwise the skin was normal and the infant in good health. No signs suggestive of irritation had been observed. The child was breast-fed and was not constipated. The eruption is not quite characteristic of urticaria pigmentosa and in any case the condition is a rare one.

Dr. VINING said he wondered whether the case might be one of congenital nævi and if Dr. Brain thought that it would be worth while to subject some of the lesions to treatment with radium.

Atelectatic Bronchiectasis : Recovery.—A. WHITE FRANKLIN, M.B.

A. L., male, aged 7 years, was first seen April 17, 1936 (aged 5 years), on account of progressive cough, loss of weight and appetite, and night sweats. He had been well until seven weeks earlier. The cough was loose, but unproductive, continued day and night, without vomiting.

Previous history.—Aged 2 years, mumps ; aged 3 years, uncomplicated measles ; aged 4 years, " congestion of the lungs " ; ill with fever, cough, and rapid respirations, and in bed three weeks.

On examination (17.4.36).—A pale, ill, boy. Temperature 101·2° F. ; pulse 104 ; respirations 30. Weight 38 lb. Tonsils and cervical lymph-nodes enlarged. Chest :

Left side larger and moves less well than right. At the left base is a triangular area of dullness with loud bronchial breathing and occasional râles. Grocco's triangle on right. Apex-beat well within mid-clavicular line in 5th left space. Otherwise no abnormal signs. Fingers not clubbed.

W.B.C. 25,200 per c.mm. Mantoux (0·1 mgm. K.O.T.) negative.

Skiagram of chest (17.4.36): Collapsed left lower lobe with mediastinal displacement to left, and emphysema of left upper lobe (fig. 1). Left diaphragm obscured by pneumonic consolidation outside collapsed area.

Course.—Admitted to St. Bartholomew's Hospital under Dr. C. F. Harris and treated with inhalations of oxygen and 5% carbon dioxide for nine days. Temperature settled after four days, cough became less and general condition slowly improved.

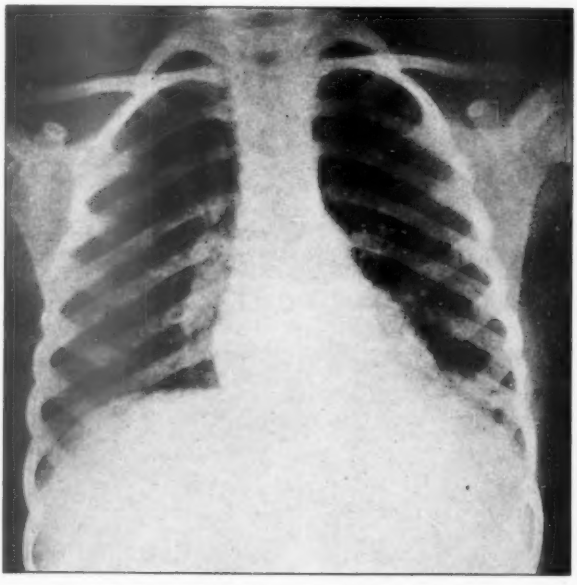


FIG. 1.—Collapsed left lower lobe with emphysema of rest of left lung (17.4.36).

Skiagram of chest (29.4.36): Mediastinum not now shifted; no emphysema: collapse persists. After intranasal lipiodol (4.5.36): Cylindrical dilatation of bronchi in collapsed area of left lower lobe (fig. 2).

Physical signs persisted at the left base until May 12, 1936, and cleared entirely by May 14, 1936, when a further chest skiagram showed residual lipiodol without a clear outline of the collapsed lobe.

Bronchoscopy by Mr. J. E. H. Roberts (14.4.36) showed that the left lower lobe secondary bronchi were enlarged and contained much mucus and clear secretion, the mucosa being bright red, and inflamed. Diagnosis: Probable bronchiectasis of left lower lobe.

Patient was discharged to Seaford for four months on May 21, 1936. Since then he has been well and symptomless. Physical examination is normal. Weight 48 lb.

Skiagram of chest (2.11.37) normal before and after lipiodol filling (fig. 3).

FIG. 2.—Lipiodol skiagram showing bronchial dilatation in left lower lobe (4.5.36).

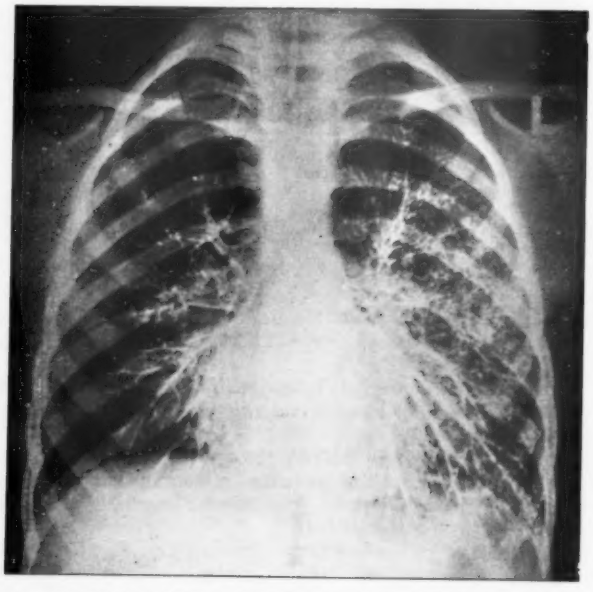


FIG. 3.—Lipiodol skiagram showing normal bronchial filling (2.11.37).

The case belongs to the group described by Findlay as compensatory bronchiectasis. That there was demonstrable dilatation of the bronchi justifies the diagnosis of bronchiectasis, but the course points the danger of retaining our original concepts of prognosis when the basis of diagnosis has been shifted from autopsy findings and gross changes in physical signs to lipiodol X-ray abnormalities.

Discussion.—Dr. G. H. NEWNS said that he had shown a similar case at a meeting of the Section in 1936.[1] From the cases reported by Findlay, and more recently by Jennings, it was evident that occasionally mild cases of atelectatic bronchiectasis recovered when the collapsed lobe expanded. He had followed up some cases of bronchiectasis in children several years previously and had found two cases of early bronchiectasis which had recovered.

Dr. PATERSON said he had seen two similar cases which recurred on three separate occasions. He would like to predict that in this case the recurrence would occur within the next year.

? Acute Rheumatism occurring in the course of a Staphylococcal Septicæmia.—F. DUDLEY HART, M.B.

Philip C., aged 7 years, was admitted under Mr. W. B. Gabriel on 17.3.37. He had fallen 40 ft. out of a window and fractured the shaft and lower epiphysis of the right femur, the ends of which were overlapping 2 in. His chin was cut, the mandible exposed and fractured, and its periosteum torn.

Condition on admission.—Temperature 98·4° F.; pulse 100; respirations 23. Urine showed albuminuria and acetonuria, both of which disappeared in four days. Cardiovascular and respiratory systems were normal. The chin wound was cleaned and sutured and the right leg put on to extension.

For the next few days there was an irregular temperature, accompanied by an increased pulse and respiratory rate. On 23.3.37 the temperature returned to normal, only to rise to 103° F. the next day. The child looked ill, and hectic fever continued.

On 30.3.37 a right parotid abscess formed. This was opened the following day; the discharge showed pus cells and Gram-positive cocci in chains, but there was no growth on culture. The temperature fell, but rose again four days later. On 14.4.37 there were signs of fluctuation and tenderness in the right inguinal region. An incision was made and thin pus, slightly green and under tension, escaped.

Microscopical examination revealed many pus cells and long chains of Gram-positive cocci. Culture: A pure heavy growth of hæmolytic streptococcus. This time there was no fall in temperature, and on 29.4.37 the wounds had to be enlarged and pocketed pus released. An abscess on the dorsum of the foot had also formed, and was opened at the same time. No abatement of fever resulted.

Skiagrams taken on 10.5.37 showed osteomyelitis of the femur and a shadow at the apex of the right lung; the heart shadow was markedly enlarged. The patient had complained of slight cough and pleuritic pain at the right base for a few days previously. The right leg was put into plaster of Paris. Twelve days later there were definite clinical and radiological signs of a pericardial effusion. Supposing it to be a pyopericardium, Mr. Gabriel aspirated 100 c.c. of sero-sanguineous fluid. As this was withdrawn the friction murmur previously apparent became more marked and was heard over a greater area. On culture the aspirated fluid gave no growth.

24.5.37: Blood transfusion, 250 c.c.

12.6.37: Patient looked distinctly better, but still had hectic fever and a swelling in the right supraclavicular region, which had appeared a few days previously over the site of the shadow in the skiagram of the lungs. Pericardial rub still present, but in addition there was a systolic murmur. A nodule was found on the right elbow. Blood culture: *Staphylococcus aureus*. Temperature swinging between 98·4° and 101° F.; much less hectic than previously. The respiration rate, varying from 25 to 60 since the onset of the pericardial effusion and thoracic signs, began to settle.

[1] *Proceedings*, 1936, **30**, 107 (Dis. in Child., 7).

5.7.37 : Still cheerful, and better in himself. Temperature persisted. Right groin still discharging. Blood culture : *S. aureus*. Blood-pressure 80/45. Nodule as before. Heart still enlarged clinically with apex beat 3 in. from the mid-line. Systolic murmur as before with reduplication of second sound at apex. Nodules appeared on the left elbow.

17.8.37 : The wound in the right groin was still discharging. Condition much as on 5.7.37. The child was surprisingly fit and well, considering the continued fever. Recession of interspaces over apex and base. The apical systolic murmur seemed somewhat rougher than at the onset.

30.9.37 : Small nodule noted over left patella. Right elbow nodules seemed larger than before. An electrocardiogram showed tachycardia, inverted T. 3 and P. 3 and some left axis deviation. Temperature gradually settling.

10.10.37 : Temporary rise in temperature. Blood-culture negative after five days' incubation.

Since then the child has not looked back. A low-grade fever of 98°–99·4° F. persists. The blood culture remains negative. The heart is still clinically somewhat enlarged and the apex beat is just beyond the mid-clavicular line. The systolic murmur persists. Blood-pressure 94/57. The hæmoglobin, 45% on 11.5.37, was 70% on 27.5.37 and 18.8.37. Sedimentation rate 37 mm. in one hour (micro. method).

The boy feels well, is happy, and has put on weight. No new nodules have appeared. The right leg is still in plaster and repeated skiagrams taken during the last two months show increased callus and union occurring fairly satisfactorily.

The nodules were excised, and on microscopical examination show the changes typical of acute rheumatism—collagenous change with areas of necrosis, new vessel formation and round basophilic cells—plasma cells, lymphocytes, and occasional binucleate cells with areas of packed mononuclears. Clinically these were typical rheumatic subcutaneous, painless nodules, and Dr. W. G. Barnard considers the sections to be classical examples of this condition.

Discussion.—Dr. A. G. SIGNY said that he had examined the sections of the nodules and agreed that they were probably early rheumatic nodules. There was a fair amount of fibrinous exudate, with a lesser degree of cellular reaction than was usually seen in rheumatic nodules. Usually nodules were examined in a later stage, when the exudate was disappearing and cellular activity provided the essential histological feature of the rheumatic node. Very often, too, nodules were examined in their last stages, when they showed only a mass of young fibrous tissue enclosing small collections of cells. All these three stages should be recognized in the rheumatic nodule.

Dr. WILFRID SHELDON said that he agreed with the diagnosis of acute rheumatism, but hoped that the members would not read into the title a suggestion that the attack of rheumatism had been caused by the staphylococcus. It appeared that the child had had a double infection—streptococcal and staphylococcal. The pus from an abscess in the groin had given a pure culture of hæmolytic streptococcus, and after the appropriate interval of two to three weeks the rheumatic attack had occurred. A less misleading title for this case might be "acute rheumatism following a localized streptococcal infection, complicated by a more widespread staphylococcal infection".

Dystrophia Adiposo-genitalis associated with Hydrocephalus in a Child aged 2 Years.—BERYL D. CORNER, M.D.

M. M., a male infant.

Past history.—Birth-weight 10½ lb. Healthy until the age of 5 months, when he was admitted to Bristol Children's Hospital with bronchopneumonia, and a cleft palate was first noticed. Readmitted, aged 8 months, with bronchitis ; weight 16¾ lb. An active baby, able to stand in his cot, and of normal appearance. Subsequently attended out-patients' with typical asthmatic attacks until 1 year old, when rapid gain in weight for two months necessitated admission for investigation. The weight was 30 lb. ; head circumference 19¾ in. ; he was walking and his intelligence

seemed above normal. A skiagram of the skull showed no definite abnormality. A little weight was lost when he was put on thyroid and low carbohydrate diet. He was not seen again until September 1937 (then aged 2 years), when he was readmitted on account of his appearance. He had no other symptoms.

Family history.—Parents healthy ; two older children healthy ; a younger child died of prematurity.

On examination.—A happy child ; talks and sings ; is walking and running well. Weight 42 lb. Height 33½ in. Highly coloured cheeks. Head circumference 20¾ in. ; fontanelle and sutures closed. Partial cleft palate ; first dentition complete. Generalized adiposity, most marked on the cheeks, breasts, and abdomen (fig. 1). Hands and feet short and broad, fingers being particularly very short and tapering. The skin is dry and fine. There is a normal amount of hair on the back and limbs, but that on the head has undergone a very marked change since a year ago, when it was silky, sparse, and curly ; it is now abundant, growing with marked rapidity, straight and dry. The penis is small for the child's age ; both testicles will descend into the scrotum, but are usually in the inguinal canals.

FIG. 1.—M. M., aged 2 years.

Blood-pressure, 80/50. Urine, daily output 20 oz. ; nothing abnormal. Eyes (report by Mr. Ramsay Garden, 14.10.37) : "Convergent strabismus ; high degree of myopic astigmatism. Fundi myopic, discs slightly pale, vessels of good calibre."

25.9.37 to 25.11.37 : In-patient, under observation ; normal temperature and pulse ; no polyuria or polydipsia ; appetite voracious ; no somnolence, more active and intelligent than other children of the same age.

Investigations.—

(1) Cerebrospinal fluid : Pressure 300 mm. of water, cells 1 per c.mm., protein 12 mgm.%, glucose 65 mgm.%, chlorides 695 mgm.%, Wassermann reaction negative.

(2) Sugar tolerance :

Fasting blood-sugar	80 mgm.%
1 hour after 50 grm. glucose	120 mgm.%
1½ hours after glucose	176 mgm.%
2 hours after glucose	80 mgm.%

No glycosuria.

(3) Skiagram of skull : Whole skull somewhat enlarged, no gross widening of sutures, or convolutional markings. Pituitary fossa shallow ; and anteroposterior diameter lengthened. No erosion of clinoids, floor, or dorsum sellæ.

(4) Ventriculography (figs. 2 and 3): 70 c.c. of air introduced. Symmetrical dilatation of lateral and 3rd ventricles. Aqueduct and 4th ventricle not filled. Optic and pituitary recesses of 3rd ventricle well defined ; pineal recess not clear.

FIG 2.—Postero-anterior ventriculograph.

(5) Urine : Normal urea concentration.

Comment.—This case shows marked adiposity and the type of skin and hair which are most compatible with the syndrome of dystrophia adiposogenitalis, although there is little evidence of genital hypoplasia, occurring at the unusually early age of 2 years. Associated with this there is a well-marked hydrocephalus with no evidence of a suprasellar tumour, but ventriculography suggests a block at the level of the tentorium.

Discussion.—Dr. PEARSE WILLIAMS said that the ætiology of obesity in children was still obscure. The case under discussion was not typical of adiposo-genital dystrophy because there was no dystrophy of the genital organs such as was present in the obese children so frequently seen. These children were, however, always older ; in his experience obesity under two years of age was rare. The redness of the cheeks and the coarse skin of the face were more in keeping with the adrenal type of fatness. An obese infant of similar age, whom he had under observation, was mentally defective.

Dr. MICHAEL ALBURY said that if the underlying lesion was an obstructive hydrocephalus of ventricular type, with a block at the level of the aqueduct, it would be difficult to account for a pressure of 300 c.c. of water in the cerebrospinal fluid.

Dr. G. H. NEWNS said he doubted whether the case shown was a true example of Fröhlich's syndrome. The pituitary fossa was normal and there was no evidence of genital hypoplasia. Dr. Ruby Stern, in her analysis of cases of cerebral tumour at the Hospital for Sick Children, Great Ormond Street, had found no example of pituitary tumour in 62 autopsies and only one suprapituitary tumour. Other series seemed to indicate that

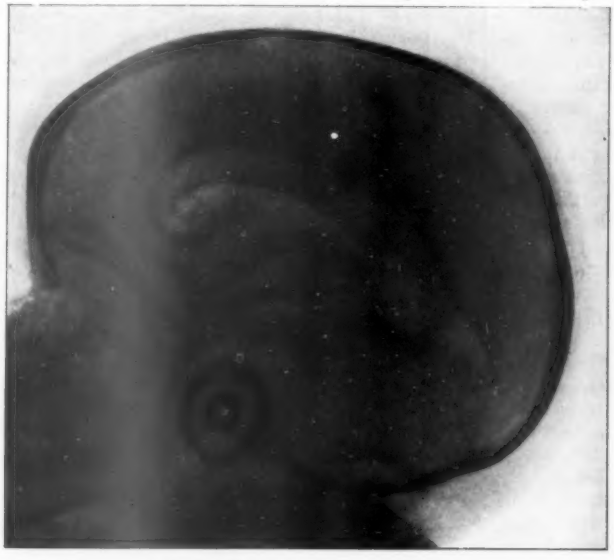


FIG. 3.—Right lateral ventriculograph.

pituitary tumours usually occurred in early adolescence and not in childhood. In a series of 50 cases of obesity in childhood, investigated by Ellis and Tallerman, there was no example of Fröhlich's syndrome. The obesity in the present case was probably not due to any pituitary disturbance and was unrelated to the hydrocephalus.

POSTSCRIPT (6.12.37).—Further investigations do not confirm the presence of obstruction of the aqueduct of Sylvius; (*a*) 1 c.c. of neutral phenol-red introduced into the right lateral ventricle appeared in the cerebrospinal fluid, on lumbar puncture, in ten minutes.

(*b*) 10 c.c. of air were introduced into the fluid by lumbar puncture, and skiagrams taken three minutes later showed a bubble of air over the vertex of the brain.—B. D. C.

Severe Rickets with Multiple Spontaneous Fractures.—R. BEVAN, B.M. (by permission of W. J. PEARSON, M.D.).

M. F., female, aged 2 years 2 months.

Her mother had noticed some difficulty in breathing for eight months—much increased during the last two days—and that the chest was of an unusual shape; there had been cough for one day.

Past history.—Full-term birth; labour precipitate; birth-weight 5 lb. Had never crawled or stood up. Intelligence normal, but speaks a few words only.

Feeding.—Breast-fed about five months; then boiled cow's milk diluted with equal parts of water and sugar added; orange juice, but no cod-liver oil at any time.

Mixed diet instituted at 1 year, consisting chiefly of mashed potatoes with milk and butter, apples and bananas. Occasionally minced meat or rabbit was added. She had had no milk for at least two months before admission.

Family history.—Four other children, two, aged 11 and 9 years, healthy; one, a boy of 6 years, shows evidence of old rickets; another, a boy of 3 years, was recently admitted to an orthopædic hospital on account of active rickets.

Social conditions.—A poor family, living in crowded, ill-lighted rooms. A reliable history was difficult to elicit, but it is probable that there was considerable neglect and that the child was seldom, if ever, taken into the open air.

On admission.—A very pale ill child. Temperature 99·2° F. Pulse 148. Respirations 60 per minute, laboured, with alæ nasi working.

Bossing of skull. Chest grossly deformed, producing a pigeon-chest with Harrison's grooves. Beading of ribs not obvious, owing to falling in at costo-chondral junctions. Both clavicles angulated with masses of callus at the bends. Spine showed slight lower dorsal kyphosis and scoliosis. Both forearms and arms bowed antero-externally. Wrists enlarged. Proximal phalanges sausage-shaped. Both thighs deformed, showing outward bowing of femora. Ankles enlarged. Muscles hypotonic.

Chest: Signs of bronchitis. Extreme respiratory embarrassment, the thorax caving in with each inspiration. Pulmonary ventilation apparently sustained by diaphragmatic action only. Abdomen: Prominent. Liver palpable 1½ in. below costal margin. Teeth: All incisors and four premolars present. No caries. Urine: Albumin, a trace; acetone +++; no casts.

X-ray examination (Dr. B. Shires).—Bones: Acute epiphyseal rickets with marked general decalcification of bones. Multiple greenstick fractures of both humeri, radii, ulnæ, and femora (figs. 1 and 2). Both clavicles show old fractures. In all, 16 fractures noted. Ribs deformed, with expansion of anterior margins, but no evidence of fractures. Skull: Slight decalcification. Lungs: Some opacity at left hilum and right base.

Blood-count: R.B.C. 4,860,000 per c.mm.; Hb. 75%; C.I. 0·8; W.B.C. 10,500. *Differential:* Polys. 34%; lymphos. 64%; monos. 2%.

Blood chemistry.—Serum calcium 4·93 mgm. per 100 c.c. serum; inorganic phosphorus 3·12 mgm. per 100 c.c. whole blood; plasma phosphatase 57 units. Blood urea 19 mgm. per 100 c.c.

Stool analysis.—Total fat 28% of dried fæces, of which 67·2% is split, 32·8% unsplit.

Test meal.—A little free hydrochloric acid present.

Treatment and progress.—Liquor calciferol (B.P.) ♏ x b.d.; calcium gluconate, 1 dram t.d.s.; ultra-violet radiation.

Improvement in respiration gradually took place, but the child is still dyspnœic. The cough also improved for a time, but has recently become worse, causing great distress.

6.10.37 (after three weeks' treatment): Serum calcium 7·97 mgm. per 100 c.c.; inorganic phosphorus 3·28 mgm. per 100 c.c. whole blood; plasma phosphatase 52·1 units.

25.10.37: Skiagrams of the epiphyses showed good progress of healing. The fractures were united with good callus and periosteal reaction. Buttressing on the inner sides of the femora and humeri had occurred (fig. 3).

15.11.37 (after eight weeks' treatment): Serum calcium 8·9 mgm. per 100 c.c.; inorganic phosphorus 3·8 mgm. per 100 c.c. whole blood; plasma phosphatase 16·9 units.

10.9.37. FIG. 1.

10.9.37. FIG. 2.

26.10.37. FIG. 3.

Dr. VINING said that though the evidence presented by Dr. Bevan made the diagnosis certain, he wished to point out how very similar the X-ray picture was to that in some of the cases of osteogenesis imperfecta.

Two Cases of Monocytic Leukæmia.—G. H. NEWNS, M.D., and A. G. SIGNY, M.B.

(I) Ivy M., aged 2½ years, was admitted to the Hospital for Sick Children on 6.10.37.

Six weeks previously the mother had noticed that the abdomen was getting larger. There was also increasing pallor. Some purpura had lately appeared and the motions had contained bright-red blood.

On examination.—The child was pale but not extremely so. Some purpuric patches were present on the trunk. The spleen was moderately enlarged. The liver was enlarged to a much greater extent. The lymphatic glands in the neck were much enlarged, those in the axillæ and groins less so.

Blood-count (6.10.37): R.B.C. 3,180,000; Hb. 65%; C.I. 1·0. W.B.C. 77,000.

Differential count (500 cells):—

Granulocytes

	%		%
Myelocytes	0·2	Eosinophils	0·2
Metamyelocytes	0·2	Basophil myelocytes ...	0·4
Polymorphonuclears ...	27·2	Basophils	10·0
Eosinophil myelocytes ...	0·2		

Non-granular Cells

	%		%
Lymphocytes	12·4	Monocytes...	37·8
Monoblasts	6·8	Doubtful cells	0·8
Total non-granular	57·8%		

Sternal puncture was performed. The following is the differential count :—

	%		%
Myeloblasts	3·5	Lymphoblasts	0
Premyelocytes	2	Lymphocytes	4·5
Myelocytes	19·5	Promonocytes	8
Metamyelocytes	10	Monocytes...	15
Polymorphonuclears ...	15	Normoblasts	2·5
Eosinophil myelocytes ...	5·5	Megaloblasts	1
Eosinophils	4·5	Doubtful cells	7·5
Basophil myelocytes ...	1·5		
Basophils	2·5		

Films stained for the oxidase reaction agreed with the differential count, the monocytic cells showing few or no oxidase granules. Supravital examination of the blood was also carried out. There were a moderate number of actively motile typical leukæmic monocytes. A differential white cell count on 8.10.37 showed :—

	%		%
Monocytes	34·5	Lymphocytes	19·5
Promonocytes	9·5	Polymorphonuclears ...	18·5
Monoblasts	3		

On 12.10.37 the total leucocyte count had risen to 177,000 per c.mm., 34% of these being monocytes. Subsequent counts were similar.

The cervical glands on the right became secondarily infected with *S. aureus.* Abscess formation took place. Œdema of the larynx necessitated a tracheotomy ; the child succumbed a few hours later.

Permission for an autopsy was refused, but biopsy of liver, spleen, and a lymph-gland was performed. There was a leukæmic infiltration of all these organs, the predominating cell being the monocyte.

(II) Jean W., aged 2 years 1 month, was admitted to the Hospital for Sick Children on 6.11.37. She had been well until about six weeks before admission. Since then she had become tired and listless. The swelling of the glands in the neck had been noticed for two weeks.

On examination.—The child was very pale. The cervical, axillary, and inguinal glands were enlarged. The spleen was slightly enlarged ; the liver edge was felt below the umbilicus. Dilated veins were present over the lower chest and upper abdomen. There were many purpuric patches on the limbs. The gums were bleeding.

Blood-count (8.11.37) : R.B.C. 3,160,000 ; Hb. 50% ; C.I. 0·8. W.B.C. 89,600 per c.mm.

Differential count :	%		%
Polymorphonuclears ...	3	Monocytes	29
Large lymphocytes	31	Promonocytes	3
Small lymphocytes	32		

1 normoblast seen per 100 white cells.

Blood-count (12.11.37): R.B.C. 1,320,000; Hb. 40%; C.I. 1·5. W.B.C. 164,600 per c.mm.

Differential count:	%	*Supravital*	%
Polymorphonuclears ...	3	Monoblasts	1·5
Lymphocytes	66	Myelocytes	4·5
Monocytes	17	Eosinophiles	2
Promonocytes	6		

The child became progressively worse and died ten days after admission.

Autopsy.—Generalized enlargement of all the lymphatic glands including the mediastinal and mesenteric groups; hæmorrhage had taken place into the glands. Thymus enlarged and firm; weight 50 grm. Liver enlarged and studded with pale areas. Spleen only slightly enlarged; pinkish-red in colour. No Malpighian bodies visible. Kidneys extremely pale; no hæmorrhages. Femoral bone-marrow pinkish-red. Peyer's patches much enlarged. Frozen sections of the liver and bone-marrow showed infiltration with mononuclear cells, many of which were monocytes.

Hirschsprung's Disease.—W. M. FELDMAN, F.R.C.P.

Ronald N., aged 11 years. Admitted to hospital 10.5.37.

History of present illness.—This boy has been constipated since birth. He has only had a brown movement after an aperient since this time. The aperient was administered regularly once every week and was followed by ten or twelve motions with a large total result. Previous to admission his appetite had been poor, he was losing weight, and his bowels were becoming more obstinate. His periods of constipation lasted a week or longer.

On examination.—Tongue furred and dry. Fauces dirty. Abdomen full and soft. Definite sausage-shaped mass felt in left upper and lower quadrant. Liver, spleen, and kidneys not enlarged. Rectal examination revealed a large but empty rectum.

Investigation.—Barium meal showed the colon to be dilated in the distal portions. Urine: No abnormality. Spinal anæsthesia, by causing temporary paralysis of the sympathetic, brought about partial evacuation of the enema.

Treatment.—Acetylcholine and esmodil were given on several occasions in varying doses with some benefit, but the doses had to be gradually increased. Previous to operation the patient was having an enema every second day.

Operation (27.8.37).—Spinal anæsthesia. Right paramedian incision. The posterior peritoneum was incised and the inferior mesenteric artery was "stripped" for one inch from its origin at the aorta. The patient made an uneventful recovery.

It is to be noted that the presacral nerves have been left intact, so that the patient, when he grows up, will not remain sterile as the result of the abolition of the contraction of the seminal vesicles.

On 10.9.37 (fourteen days after operation) he had a normal bowel movement.

From 12.9.37 until his discharge on 19.9.37 he had a normal daily motion.

Hirschsprung's disease. Before operation.
Barium enema: (*a*) Before evacuation some five pints of enema were given. Note the absence of haustration.

Before operation.
Barium enema; (*b*) After evacuation. Note absence of haustration.

Hirschsprung's disease. After operation.

Barium enema : (*a*) Before evacuation only about two pints of the enema could be retained. Reappearance of haustration.

After operation.

Barium enema : (*b*) After evacuation. Note normal size and haustration of the bowel.

Colitis associated with Stricture of the Recto-sigmoidal Junction.—M. D. RAWKINS, M.D. (introduced by H. L.-C. WOOD, M.S.,F.R.C.S.).

History.—Jean S., aged 8 years 4 months, was a normal baby at two years of age when she had an attack of fever and rash. ? measles.

For six months following this attack she was intermittently constipated, blood being present in the stools on these occasions. Chronic diarrhœa then set in, and has remained permanently present ever since. From June to August 1933 she was an in-patient at the Hospital for Sick Children, Great Ormond Street, where a diagnosis of chronic colitis was made. She was treated as an in-patient at St. John's Hospital, Twickenham, from February to May 1935. Her weight on admission was 2 st. 8 lb. 4 oz., and on discharge 3 st. 0 lb. 12 oz. She was pyrexial—between 98°–100° F.—the whole of the time. She was treated by low residue diet, vitamins, daily barium enemata for the first fourteen days followed by colonic lavage with albargin.

Past history.—Breast-fed to seven months. Severe attack of diarrhœa and vomiting at eleven months, otherwise nil.

Family history.—Sister aged 3½ years; healthy; passed blood and slime on one occasion when a baby; has passed a mucous cast about 3 in. long on two occasions since; nothing abnormal discovered on abdominal and rectal examinations of this child. Mother and father both healthy.

Condition on examination.—A happy, healthy-looking child. Weight 3 st. 5 lb. 8 oz. Colour good. Tongue partially covered by white moist fur. Teeth: Some missing, remainder good. Tonsils slightly reddened; tonsillar glands palpable. Heart and lungs normal. Abdomen not distended. Spleen not palpable. Transverse and descending colon thickened and palpable; not tender. *Per rectum*: Stricture felt a finger's length from anal orifice.

Sigmoidoscopy: Stricture centrally situated in the lumen of the bowel. The circumference of the orifice is the size of that of a lead pencil; the wall is smooth, and tough in consistency. The mucous membrane of the wall distal to the stricture is replaced by bleeding granulation tissue. The stricture is situated 4 in. from the anus.

Radiological examination: Cæcum normal in appearance, but undescended. Appendix patent. Lack of normal haustrations of transverse and descending colon. Stricture at recto-sigmoidal junction.

Laboratory findings.—The fæces show a normal bacterial flora; no amœbæ. Cultures show no member of the typhoid dysentery group.

Blood-count: R.B.C. 5,400,000; Hb. 96%; C.I. 0·9; diameter of reds 6·9 μ; W.B.C. 30,000. (*Differential*: Polys. 57%; lymphos. 37%; large hyalines 5%; eosinos. 1%.)

Blood Wassermann reaction negative. Urine: Normal colour. Specific gravity 1020; acid; no albumin; no sugar; centrifuged deposit shows nothing abnormal.

This case is shown for advice on treatment and for discussion as to the probability of the colitis being the result of a congenital stricture, or the stricture being a cicatricial result of the colitis.

The PRESIDENT said he thought that the stricture was inflammatory in origin.

In regard to treatment, he suggested multiple incisions of the cicatricial ring under direct vision through a proctoscope, followed by forcible dilatation and subsequent daily passage of bougies. This method was free from risk, and had proved successful in similar cases under his care.

Pneumonia with Unusual Features in an Infant.—R. A. PELLEW (introduced by Dr. REGINALD LIGHTWOOD).

P. B., a female, aged 15 months, was admitted under Dr. Donald Paterson to his ward at Westminster Hospital on 13.10.37.

History.—For eighteen days previous to admission there had been cough, dyspnœa,

and increasing pallor. The fourteen days before admission had been spent in a babies' home.

On examination.—A pale child, coughing most of the time, and in considerable respiratory distress. The heart was in the normal position, but examination of the chest showed diminished movement on the left side, with dullness to percussion, and two distinct areas of consolidation, the impression being that these areas were of different ages. The diagnosis was therefore " pneumonia migrans".

Blood-count: Hb. 45%; W.B.C. 10,300. X-ray examination confirmed the diagnosis of consolidation.

The child was placed in an oxygen tent, and progressed satisfactorily, with slight elevation of temperature, pulse, and respiration, till about fourteen days later, when the temperature began to rise. The W.B.C. count at the time was 13,800. One month after admission it was noticed that the fingers had begun to club, and that the temperature was swinging. The W.B.C. count was 27,000. A needle was inserted into the 8th intercostal space in the anterior axillary line, and about 2 c.c. of pus was withdrawn. This grew pneumococci in pure culture. A skiagram taken with the child in the upright position at this time showed three distinct cavities in the left lung, two of these having fluid levels. Aspiration of the upper cavity has been carried out every second day, with the removal of about 20 c.c. of pus, growing pneumococci in pure culture. The needle is inserted in the 5th intercostal space in the posterior axillary line, to a depth of one inch and a half.

Dr. C. PAGET LAPAGE said that he had under observation a case in a chronic stage. Skiagrams showed cysts in the lung, with fluid levels. The condition in Dr. Pellew's case might be cystic disease but was probably saccular bronchiectasis high up in the lung.

Section of Therapeutics and Pharmacology

President—J. W. TREVAN, M.B.

[*November* 9, 1937]

Treatment of Exophthalmic Goitre by Deep X-rays

By E. P. POULTON D.M., and W. L. WATT, M.D.

THE use of X-rays in the treatment of exophthalmic goitre must have begun soon after X-rays were discovered, but in these early days the main effect was to burn the skin without producing any change in the gland beneath. Nevertheless, a few physicians who made a special study of the treatment—e.g. the late Dr. Florence Stoney—did obtain some favourable results [1]. Then the era of operative treatment began and the technique was well on its way to perfection by the time that the introduction of deep X-rays enabled the subject to be reopened. The use of deep X-rays has been prejudiced by the earlier failures of radiation and the increasing successes of surgical intervention.

So little was known when the first case was treated in April 1924 that the lines of previous experience with ordinary X-rays were followed [2]. Gradually it was found that the thyroid would tolerate heavier and heavier doses until finally the present method has been adopted and has not been materially changed for the past five years.

One course of treatment consists in giving five radiations to the thyroid : (1) Right antero-lateral ; (2) left antero-lateral ; (3) right postero-lateral ; (4) left postero-lateral ; (5) whole gland directly from the front. The total depth dosage to be not less than 80% of a skin erythema dose.

Ambulatory cases.—In the case of young patients, in which time is not an essential factor, the first course of deep therapy should be sufficient to effect a cure.

In the case of the worker, where time is important, the full course should be given as soon as possible. It is preferable for the patient to be in bed for a week or ten days during the treatment and to rest as much as possible for one month afterwards. In cases of necessity, where the work is light in character, the patient is allowed to continue it even during treatment.

Severe cases.—The first course should be given as soon as possible ; rest in bed for ten to twelve days is essential, and a month's complete rest afterwards if possible. Results should be assessed in three months. *With marked improvement* further treatment should be postponed for a second three months ; *with moderate improvement* a second full course of treatment should be given in exactly the same manner as the first. Should the symptoms still persist at the end of a year, then the question of a third course, or other methods, should be considered. *With no improvement*, a decision between further radiation and other treatment must be made.

Grave cases.—Combined medical treatment is required with radiation, the primary spread over three or four weeks, with complete rest for at least two months and further treatment as necessary.

Our first patient was treated in 1924 with deep X-rays. He was a boy of 16 who had had the disease for one and a half years and had already been treated by X-rays. Fuller details of this case have been published [2] elsewhere. We began treatment cautiously and this, with the previous applications, produced a severe skin burn ; but at that time he was a bad case with a basal metabolism of +43%. Improvement has been marked, and when seen a year or two ago he was employed moving heavy packages about in a warehouse ; but he has not been cured. In 1934 details were given of 61 cases treated up to 1931 with 40 additional cases treated between July 1931 and July 1932 [2]. The results, on Fraser's classification [3], were as follows : From 55% to 60% could do their former work without difficulty (Class 1) ;

from 30% to 40% could do their work with difficulty, or had to undertake a lighter job (Class 2); from 5% to 10% led an invalid life (Class 3). One patient was reported to have died of chronic phthisis, and another of angina associated with jaundice.

The object of the present communication is not to repeat the previous analysis after a further interval of three years, but to show the results by the demonstration of as many patients as could be persuaded to come here for this purpose. The details of 30 such cases are given in Table I.

As far as the hospital cases were concerned they were unselected, but invitations were sent to all the patients directly under the care of one of us and also to a few others who lived nearby. Thirty patients actually attended; six other patients accepted but did not come to the meeting. The majority had not been seen for three years and their present condition was unknown. Among the 30 cases were five private patients of E. P. P. who were invited because they had continued to keep in touch with him. At the demonstration the patients were classified and 21 (70%) were included in Class 1 and nine (30%) in Class 2. That the pulse remained normal in rate during the examination, when a rise might have been expected from patients with Graves' disease subjected to such an ordeal, was commented upon at the demonstration.

TABLE I.—CLASS 1.

Case No.	Sex	Present age	History	Deep X-ray therapy	Years since 1st deep X-rays
1119	F.	50	19 months' fainting attacks. 15 months ordinary X-rays. B.M.R. +60%	Nov., Dec. 1926; Feb. 1928; Dec. 1928; Oct. 1929	11
1344	F.	55	4 years' severe symptoms. B.M.R. +69%	May, July, Sept. 1927; Jan. 1928	10½
1363	M.	54	6 months' weakness in legs and shakiness. B.M.R. +37%	June, July, Oct. 1927	10
1634	F.	52	2 years' severe symptoms. B.M.R. +40%	Nov. 1927; Feb., June, Sept. 1928	10
1651	F.	52	6 months' sleeplessness, dyspnœa, and exophthalmos, also arthritis of shoulder and hands	Dec. 1927; Feb., May, Sept. 1928; Jan. 1929	10
1801	F.	37	2 years' symptoms. Operation right lobe, February 1927, recurrence	March, May 1928	9½
2412	M.	60	2½ years' symptoms. B.M.R. +26%	Jan., Mar. 1929	8½
2903	F.	32	6 months' severe symptoms	Oct., Dec. 1929	8
3055	F.	48	5 years' symptoms, severe. B.M.R. +28%	Dec. 1929; March, July 1930	8
3298	F.	37	18 months' symptoms, also rheumatism. B.M.R. +102%. (Now on thyroid prescribed by her doctor)	May, July 1930	7½
4314	F.	54	18 months' severe symptoms. Auricular fibrillation. (Refused quinidine.) B.M.R. +47%. (Has gained 24 lb. in weight)	Nov. 1931; Jan., June 1932	6
4556	M.	50	6 years' symptoms, severe. Family history of condition, B.M.R. +29%	April, June, Oct. 1932	5½
5687	F.	52	3 years' symptoms	Aug., Oct. 1933; Feb. 1934; April 1935; Nov. 1936	4¼
6460	F.	40	3 years' tumour. Diarrhœa. Palpitation, profuse sweats, also arthritis of shoulder. B.M.R. +18%	June, Sept. 1934; Aug. 1935; Jan. 1936	3½
6993	F.	47	Treated by ordinary X-rays. B.M.R. +25%	March, May 1935	2½
7437	M.	60	2 years' symptoms associated nephritis. B.M.R. +45%	Nov. 1935; Feb., May 1936	2
3669	F.	33	1 year's symptoms, also amenorrhœa, treated unsuccessfully with iodine. B.M.R. +31%. (Has since gained over 2 st. in weight)	Dec. 1930; Oct. 1931; June 1932	7
5682	F.	70	2 to 3 years' symptoms, also aphonia. B.M.R. +45%	Aug. 1933; July 1934	4+
6067	F.	46	All symptoms. Severe dyspnœa for 6 months, profuse sweats and chest pains. B.M.R. +50%	Jan., April 1934; Nov. 1936	About 4
6623	F.	45	9 months' symptoms. B.M.R. +45%. (Since gained over 1 st. in weight)	Oct. 1934; Jan. 1935	3
7171	F.	49	18 months' symptoms, also rheumatism. B.M.R. +28%	July, Nov. 1935	2½

CLASS 2.

Case No.	Sex	Present age	History	Deep X-ray therapy	Years since 1st deep X-rays
610	F.	34	2 years' symptoms, severe. B.M.R. +18%. (Has gained 10 lb. in weight)	July, Sept., Nov. 1925; May, Sept., Nov. 1926; May 1927	12½
7982	M.	52	6 months' severe dyspepsia, headache, tremor, loss of weight, and constipation	May, Aug. 1937	—
4664	F.	43	3 years' severe symptoms treated by ordinary X-rays. (Operation for polypus uteri in 1935)	May, July 1932; March 1934; Oct. 1935	5½
5249	F.	23	Several years' symptoms. B.M.R. +43%	Feb., April, Aug. 1933; May 1934; Oct. 1935	4½+
5640	F.	35	Thyroid enlarged since age of 12 years. 2 years' toxic. Treated by ordinary X-rays, rest, &c. No effect	July, Oct. 1933; March 1934	4¼
6645	M.	57	Severe symptoms for some years. B.M.R. +17%	Sept., Nov. 1934; May 1935; Feb. 1935, Feb. 1937	3+
7645	M.	51	B.M.R. +26%	July, Oct. 1936	—
5457	F.	58	Graves' disease began in 1915. Diabetes, 1931; auricular fibrillation, diarrhœa and vomiting. B.M.R. +67%. Weight 78¾ lb. (expected 107 to 133 lb.). Weight now 130½ lb. B.M.R. −11%. Insulin 34 units	May, July, Dec. 1933; Oct. 1934 (⅔)	4½
6241	F.	40	Pains in chest and nervousness for 15 months, stopped work. Treated with iodine by doctor. B.M.R. +32%	(Small doses), April, July 1934; Jan. 1935; Feb., March, May 1936; Jan. 1937	3½

As an illustration of the effective treatment the photograph of Case No. 6067 (Class 1) taken in January 1934 (fig. 1) before treatment and that taken recently (November, 1937; fig. 2) may be consulted.

FIG. 1.—M. W. Before treatment (January 1934).

FIG. 2.—M. W. After treatment (November 1937).

No. 2412 (Class 1) came with the following statement from his firm : " He has been employed since October 2 as a navvy on the setting-out for and excavating for drains. He is an excellent workman, a good timekeeper, and is giving satisfaction in every way."

The course of the disease under treatment by X-rays is shown in Chart I (G. U.) and in Chart II (E. P. P.).

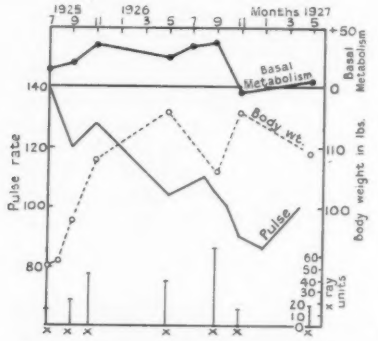


CHART I.—Case 610 (G. U.). Progress with deep X-ray therapy. Highest dosage 64=3,000 r units for series.

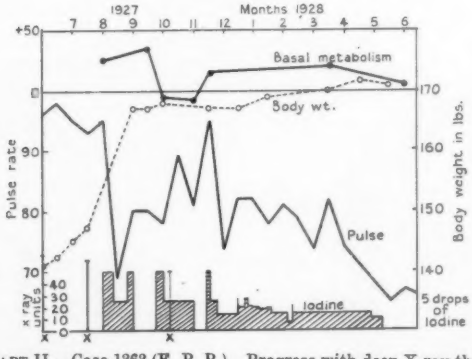


CHART II.—Case 1363 (E. P. P.). Progress with deep X-ray therapy. Highest dosage 64=3,000 r units for series. Highest dosage of French tincture of iodine=10 drops daily.

G. U. No. 610 (Class 2) whose treatment was begun twelve and a half years ago suffered subsequently from cardiac pain, pleurisy, fibrositis, constipation, and later pyelitis, while a papilliferous ovarian cyst was removed in 1931. The Graves' disease itself has disappeared and since then the following results for basal metabolism at different times have been obtained : November 1927 – 11%, July 1928 – 4%, December 1929 + 5·5%, July 1933 – 2%. Administration of glucose was found to be effective for the relief of cardiac pain and she has recently much improved in health and has begun to drive a car once more.

The case of E. P. P. (No. 1363, Class 1) was of interest owing to the very great weakness that developed. It was first noticed as a painful stiffness which made it

difficult to withdraw the foot from the accelerator pedal to put it on the foot-brake while driving. Later on during treatment it was found difficult even to hold a book up to read while at rest in bed. This weakness was well illustrated on one occasion when as the patient was getting out of a car on to the pavement his knees gave way and he fell over, severely wrenching the extensor tendons ; that night it was impossible to walk upstairs to bed, since his arms and legs were too weak, and he had to be supported upstairs by pressure exerted in both armpits by two helpers. In spite of this paresis he was walking about again next morning. A test described by Plummer is based on the fact that this weakness usually prevents extension of the knees. In this test the patient is asked to step up from the ground quickly on to a chair or stool. Inasmuch as other muscles are also commonly affected, it is safer to question the patient than to rely on this test alone. Iodine had a marked effect on the pulse-rate when first given, but the rate increased again and eventually the iodine was stopped when very frequent extrasystoles appeared ; these disappeared almost the day after the iodine was stopped. They reappeared on a subsequent occasion with iodine treatment, to disappear again on the cessation of iodine.

Progressive muscular atrophy has been considered by some neurologists to be a characteristic feature of exophthalmic goitre, but the name is a misnomer, since the symptoms of atrophy and weakness disappear with treatment. One patient, J. K. (not reported) aged 51, was observed by her doctor to have dropped feet and was so weak that she had to help herself upstairs by the banisters. The knee-jerks and ankle-jerks were present. She has just completed the first course of treatment. Another patient found that she could walk upstairs only by pulling on the carpet. Another patient, Mrs. T. R. H. (not included in our group), aged 56, was seen in March 1936 on account of a large nodular goitre, without symptoms of hyperthyroidism ; blood-pressure 200/100, enlarged heart (width 14 cm.), (width of aorta 7 cm.), body-weight 116 lb. Symptoms of the disease developed and on July 15, 1936, the basal metabolism was + 31% ; 5 exposures of deep X-rays were given in September 1936 and at the same time she was taken to a neurologist owing to a wasting of the left arm and some pain in the limb. She was reassured that progressive muscular atrophy was not developing, and X-ray examination was advised in order to exclude suspected cervical rib. In March 1937 she was better, but noticed palpitation and shortness of breath on exercise, and her basal metabolism was + 33%. There is little doubt that further treatment with X-rays should have been carried out in December 1936. Operation was now decided on and recovery was rapid and satisfactory. This case illustrates the fact that repeated deep X-ray treatment may be required to produce a result equivalent to operation. Relapses after apparent cure occasionally occur. Four such cases have been noted ; in three a further radiation gave excellent results and the fourth was satisfactorily operated on. The time of recurrence was just under three years.

Three cases were sent for pre-operative radiation and the combined result was believed to be excellent. Three other cases are known to have been operated on after the first course of radiation and three cases after the second course. Two of these cases at least have definitely improved as a result of radiation.

It is also suggested that the two methods of treatment might be combined—an operation of not too great an extent in the first place and subsequent deep X-ray treatment if necessary. The combination of operation and subsequent radiation would be preferable to removal of nearly the whole of the gland, with the greater risk of myxœdema. At the same time we are not prepared to say that there is any case of exophthalmic goitre or toxic goitre, however grave, in which, given the necessary time and patience, satisfactory improvement will not be obtained by deep X-rays alone. Of the cases we demonstrated we may quote that of No. 3298 (Class 1) as showing myxœdema after treatment. Improvement under the administration of

thyroid has been reported, and since the patient can carry out her occupation just as well as before the disease, she has been considered as belonging to Class 1.

Emphasis has been laid in the past on focal sepsis, particularly that type involving the tonsils, as an important factor in keeping up a condition of hyperthyroidism. It is true that when such sepsis is present it ought to be dealt with, but we think it leads to a waste of time to treat the focal sepsis without dealing with the gland from the outset. For instance, in one case, No. 6623, deep X-ray treatment was first begun in October 1934, and at that time crypts in the tonsils were observed out of which a creamy material could be expressed. These were still obvious in January 1935, when a second course of treatment was undertaken. The patient was then instructed to have the tonsil squeezed regularly with the finger inside and outside the mouth, to get rid of this material. When seen in May 1935 the tonsils showed great improvement. One of us (E. P. P.) has employed massage of the tonsils with success in other instances, and thinks it preferable to suction as a means of evacuation.

In this series of cases auricular fibrillation has been uncommon, but details are given of three cases.

In case No. 4134 the patient had auricular fibrillation at the time of treatment. She refused quinidine and the auricular fibrillation has continued up to the present time. The pulse is slow and the heart is not excitable. As she insisted that she was now able to do without difficulty everything she had done before the disease, we put her in the Class 1 category, in spite of the continuance of the auricular fibrillation. We would suggest that the latter is not of such great importance when the thyroid intoxication has been dealt with successfully.

In case No. 5457 the patient, when first seen in November 1932, was very ill with diabetes and Graves' disease. She was first treated with 42 units of insulin in three doses and the treatment of the Graves' disease was begun in May 1933. The auricular fibrillation has continued up to the present time, but as the width of the heart in April 1937 was enlarged (14·5 cm.) and the body-weight was 130 lb., it was considered better not to use quinidine. The patient has improved remarkably, but since she is not so strong as before she had the disease she is considered as the Class 2 type of recovery. In April 1937 her basal metabolism was -11% and she was taking 0·2 mgm. thyroxine once a day and insulin 30 units, in three doses, per day; more insulin has, however, been advised.

In a severe case—that of Mrs. M. C. K., aged 62 (not demonstrated), with a basal metabolism of $+ 58\%$—auricular fibrillation developed during deep X-ray treatment. The fibrillation disappeared without treatment, but the ventricular complexes are abnormal. At the present moment she writes that she is certainly better than when seen last.

We have been informed that auricular fibrillation with symptoms of thyroid intoxication have not infrequently followed on operation, perhaps the above case is an example. In one or two cases we have also had reports from the patient's doctor of exacerbation of symptoms, following the first course of deep X-ray treatment, but have not observed this in hospital.

Adenoma is not particularly susceptible to medical treatment and does not tend to diminish or disappear. If associated with toxic symptoms it may be treated as in ordinary cases. In recurrent adenoma the rays appear to prevent any further recurrence. One case had been operated on twice previously and one three times. The latter case had been followed for over ten years. The original large adenomas have slowly diminished, the smaller ones practically disappeared.

Four patients, apparently cured, died accidentally: One from an operation for gastrojejunostomy, another, a doctor, from an anæsthetic after a serious motor accident, the third, recently, from hæmorrhage during parturition, and the fourth from influenza with secondary pneumonia.

SUMMARY

Deep-therapy radiation is an efficient method for treatment for toxic goitre. It will act equally well whether the patient has been previously treated by ordinary X-rays or not; if there has been much of the latter there is a risk of telangiectasis. It also acts well with recurrences after operation. It should play an especially important part in the young and grave class of case. It is not a bar to subsequent operation.

The treatment is bloodless, it is not dangerous to life, and good results appear to be more or less permanent.

As in many other diseases, .. should work hand in hand with medicine and surgery, each the complement of the other.

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2 POULTON, E. P., and WATT, W. C., *Lancet*, 1934 (ii), 535.
3 FRASER, F. R., *Brit. M. J.*, 1931 (ii), 739.

Discussion.—Sir THOMAS DUNHILL said he had long taught that in the early stages of the disease, and especially in young patients, X-ray treatment, together with medical management, could restore equilibrium. He was more doubtful of its use in elderly patients who had long suffered from the disease, particularly when auricular fibrillation, congestive heart failure, glycosuria or, especially, mental disturbance, was present. He felt that in any large hospital there were sufficient cases for the physician in charge of the medical unit to try the various methods of treatment over an extended period, aud with the follow-up departments as ably administered as they are now, an adequate amount of evidence should become available to guide practitioners.

While admitting that many of his patients of the type he had indicated had been restored to an economic level, he was obliged to say on the other hand, that 170 patients had been sent to him for operation after undergoing what had been regarded as adequate X-ray treatment, and in 29 of these auricular fibrillation had developed after the X-ray treatment and before they came for operation. While it was important to recognize when X-ray treatment was helping the patient and to adopt other measures in the cases when it was failing to do so, it was often said that X-ray therapy made subsequent operation very difficult. This was so in the early days when it frequently induced telangiectasis, but that argument could not be advanced now that the treatment was more under control, and surgeons should be capable of operating even if X-rays had been employed. His view was that operation should be performed when complications were present, and in the large class of cases in which, for economic or domestic reasons, early and fairly complete restoration to health was of importance.

Practitioners of any branch of medicine should be alert to the achievements of their colleagues in other branches.

Dr. S. LEVY SIMPSON said that the series of patients shown this afternoon compared very favourably with a large series observed by him after thyroidectomy, carried out under most favourable conditions. Deep radiation was, therefore, apparently a considerable therapeutic advance, and it was essential to define its field of application, and not to permit the question to be obscured by a gracious assumption that this was no challenge to surgery. Hitherto, although first attempting medical treatment and radiation in exophthalmic goitre without auricular fibrillation, he had never hesitated to seek surgical aid without delay in older patients, e.g. those aged 40 or over, with secondary thyrotoxicosis (toxic adenoma), especially when complicated by auricular fibrillation. In his experience—and that of most observers—he thought, ordinary radiation had been useless in this type of case. If, however, the experience of Dr. Poulton and Dr. Watts had led them to the conclusion that the technique of deep radiation was effective in this type of case, it constituted an observation of fundamental importance, and meant that the field for surgery had become much more limited.

He doubted whether Dr. Watt's intention of increasing the dosage so as to obviate the necessity for repeated treatments, spaced over a period, was wise. It was generally thought that hyperthyroidism was secondary to a primary stimulus (? thyrotropic, ? undetermined), and unless one contemplated recurrent radiation over a period, it would be necessary to give such a dose of X-rays as would render the thyroid incapable of responding subsequently to such a stimulus. This might mean a myxœdema dose.

He was interested to observe that three patients in the series showed a tendency to bradycardia although there was no other evidence of hypothyroidism, except, perhaps, in one case, a slight thickening of the skin. One patient still had auricular fibrillation, but at a rather slow rate, as if under the influence of digitalis, although no medicine was in fact being taken. In many other patients, the pulse was remarkably steady, in spite of the excitement of the demonstration.

Dr. EVAN BEDFORD expressed surprise that Dr. Poulton encountered auricular fibrillation so rarely in cases of toxic goitre, as he (the speaker) saw it frequently. He assumed that Dr. Poulton's cases were seen and treated at a relatively early stage of the disease. Comparing Dr. Poulton's patients treated by radiotherapy with his own cases, treated by thyroidectomy, there was a marked difference, for most of the latter had some degree of hypothyroidism, and the pulse was slower and less jerky. Admittedly, some degree of myxœdema was often desirable in those with badly damaged hearts, and in such cases he advocated a radical, or occasionally even a total, thyroidectomy, which was not required in the mild or early cases without cardiac damage. Looking at Dr. Poulton's patients as a whole, he was satisfied that radiotherapy had produced an enormous improvement, though some of them still had slight hyperthyroidism. Further experience was required to show whether a case of toxic goitre with auricular fibrillation and heart failure could be relieved completely and rapidly enough by radiotherapy to justify its use in these circumstances. On the evidence at present available, he would still favour radical thyroidectomy for thyrotoxic heart failure.

Mr. VAUGHAN HUDSON said that, as a surgeon, he saw only the failures of medical surgical, and radiotherapeutic treatment. He had not found that radiotherapy made surgery more difficult, but, on the other hand, he was interested to find that although it had produced a decided diminution of symptoms and had caused the majority of the signs to disappear, tachycardia persisted or auricular fibrillation remained. In one or two cases, in spite of apparent cure by radiotherapy, the patients had subsequently developed auricular fibrillation. This might or might not be a question of dosage. If it was a question of dosage it would be necessary to produce a still greater effect on the gland, and to attempt to approximate the patient more closely to a subthyroidal state. Only time and carefully controlled cases would settle this question.

Had Dr. Poulton any evidence showing that X-ray therapy had a deleterious effect upon the parathyroid glandules, as, theoretically, this was a potential danger in treatment.

Mr. CHARLES DONALD said that many of the patients who came to him for operation had been taking iodine over a prolonged continuous period, in some cases for more than a year. This had resulted in a hard colloid gland, and he thought that the overdosage had produced a condition from which recovery or marked improvement by medical means was impossible and that operation was the only possible course. He would be glad of information as to any success Dr. Poulton had had with this type of case; he himself thought it highly unlikely that X-rays could produce any beneficial change. Had Dr. Poulton had any success in cases in which mental symptoms were associated with the disease.

Uncomplicated retrosternal goitre did not entail a bad operative risk but when a retrosternal goitre was associated with purulent bronchitis the outlook was grave. Had Dr. Poulton succeeded by X-ray therapy in producing such improvement in a case of this kind as would allow the operation to be performed without involving the serious risk of pneumonia?

Dr. POULTON (in reply) said there was no evidence that the parathyroids had been injured by the treatment. He would not say there was any case that could not be treated with deep X-rays with hope of success, including hard glands mentioned by Mr. Donald. He had had no experience with mental cases (they were uncommon in this country) or with purulent bronchitis.

Section of Medicine

President—H. LETHEBY TIDY, M.D.

[*November* 23, 1937]

DISCUSSION ON THE CLINICAL VALUE OF THE TOMOGRAPH

Dr. J. B. McDougall: There is no department in medicine which owes more to the science of radiology than that which deals with diseases of the chest. Despite the fact that the chest physician has at least four time-honoured methods of eliciting physical signs at his command, it has to be recognized that the X-ray film can convey much more than any individual sign or group of signs can discover.

But even the radiologist will be the first to admit that the usual antero-posterior and oblique X-ray films of the chest leave out much detail which may be of great importance in arriving at a diagnosis and in prescribing treatment. In these days especially, when the surgeon has also come into the field of chest diseases, it is becoming even more imperative that accuracy in localizing cavities, for example, and data concerning the pathology of any given lesion, should be obtained. One of the difficulties in interpreting chest radiograms is the superimposition of the normal structures of the chest ; another is the superimposition of certain pathological deposits in the lungs themselves.

Among the normal structures which impair clear vision of the pulmonary tissues, may be included the clavicle, the scapulæ, the ribs, and, in females, the mammary glands ; whilst in the pathological lung there are frequently (in addition to the normal bony shadows) the fibroid outlines of walls of cavities, crossing and intertwining with each other, calcified deposits obscuring important outlines, to say nothing of pleural thickenings and various forms of pulmonary collapse which defy disentanglement by the most experienced radiologist and clinician.

Most of us are, no doubt, familiar with the radiological findings in a case of thoracoplasty, where the operation has been performed some months previously. There is, perhaps, no radiogram more difficult to interpret, for in such cases the amount of lung tissue available for clear and distinct inspection is frequently minimal and the shadows shown by the distorted ribs, new bone formation, and the collapsed lung itself, add greatly to our difficulties in interpretation. Similarly, it is impossible by the usual radiological methods to give an opinion of the state of the underlying lung in many cases of pleurisy with effusion ; nor has there been hitherto any reasonably sure radiological device for determining bronchial obstruction when this is due to the presence of some soft-tissue growth.

It was with a view to attempting to overcome these and other difficulties that Ziedses Des Plantes (1932), Grossmann (1935*a*), and others, were led to introduce tomography, by which is meant the " sectioning " of the organ to be examined by X-rays, so that it becomes possible, firstly to analyse the organ in sections or slices, and then to give a synthesized picture of its structure.

The more recent impetus which tomography has received has been due largely to the work of Grossmann (1935*b*) and Chaoul (1935) of the Charité University Clinic of

Berlin, for they have succeeded in devising an apparatus which answers the purpose well and is certainly an advance on the rather complicated mechanism of previous attempts which had the same object in view. I am, however, far from satisfied that such an apparatus is, in fact, necessary. My colleague, Dr. Twining, will be able to show you that tomographic images can be produced by a relatively simple mechanism, and that the complicated mechanism of the German instrument may not be essential. Dr. Gaillard, of Lyons, at a recent meeting of radiologists at

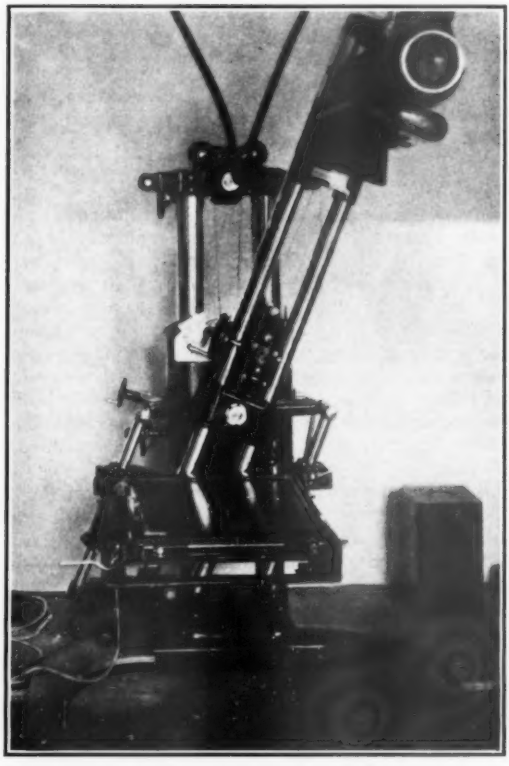

FIG. 1.—The Tomograph.
(By permission of the Editors of *Tubercle*)

Strasbourg, showed how he had modified, cheaply and simply, an ordinary X-ray apparatus to permit its use for tomography.

I shall not go into the physics or mechanism of the tomograph, for these have already been dealt with fully in recent literature, and more particularly in an article by Greineder (1935). Figure 1, however, shows the tomograph which we have been using in our work at Preston Hall, and it will be seen at once that the main principle in this new method is that the tube and the film-holder move in opposite directions during the exposure. The movement is made by an electrical contact, and both

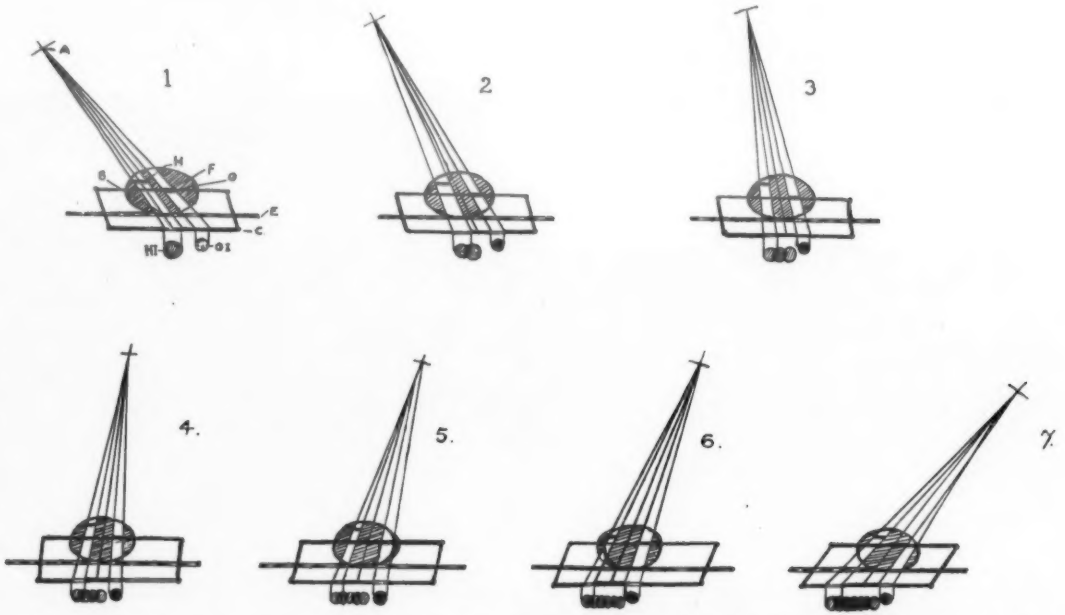

FIG. 2.—A diagrammatic representation of the essential movements of the tube and film-holder in tomography. All objects in plane G are reproduced on the film with a minimum of blurring or distortion. All objects in front of and behind plane G are distorted in varying degrees; the amount of distortion increasing as the various sections increase their distance from plane G. Hence, all objects in the plane of section are clearly produced, whilst all objects above and below the plane of section are so diffused that they do not appear at all.

the tube and the film in their transit describe an arc the extent of which can be varied during movement from one extreme to the other. The tube is focused on the particular section of the organ concerning which information is desired. When this is done the apparatus is adjusted so that the tube is moved to the one extreme of au arc of approximately 45°, and when the electrical contact is made the tube and the film-holder move through the arc in opposite directions.

Figure 2 shows the essential physics which enable shadows anterior and posterior to the plane of focus to be sufficiently obliterated from the final picture to become, in fact, almost invisible.

It would appear that tomography has made unusual strides in a short space of time, and, as was to be expected, terminological difficulties have arisen. Each pioneer—in accordance with his preference for Latin or Greek—has chosen his pet title, and collectively these names have added something more to the chaos with which much medical nomenclature is shrouded. For example, we have planigraphy, stratigraphy, laminagraphy, and tomography, but of these " tomography " has at least the merit of sound and constant etymology, and it is to be hoped that it will remain in use—in this country, at any rate—to indicate the procedure by which radiological sections of an organ may be taken.

It might be inferred from what I have said that tomography is limited to investigations in lung diseases. This is not so. There are many fields open for research in this subject, and Dr. Twining will be able to show you some which are outside the lung field and which offer great promise. I believe, however, that it is in lung diseases that tomography has its widest scope, and my own work has been devoted almost entirely to lung diseases and more particularly to pulmonary tuberculosis.

FIG. 3 (Case 1).—A clear case of effusion into the chest following an artificial pneumothorax. There is some evidence of cavity formation in the left upper zone, but the detailed pathology of the right lung is largely obscured on account of the pleural opacity.

FIG. 4.—A section of the same chest as in fig. 3, taken 5 cm. from the front. The collapsed lung is shown in definite outline, with interlobar thickening and collapse of the right upper zone. There is, however, still no detail to be seen in the collapsed area. The deviation of the trachea and the outlines of the bronchi are clearly visible. In the left upper zone at this level there is also to be seen what appears to be the anterior pole of a cavity, surrounded by diffuse tuberculous infiltration.

FIG. 5 (same case).—Photograph taken 7 cm. from the back of the chest. The collapsed lung is still well seen in outline, and two cavities—or one large one intersected by a thick band of tissue—are to be seen in the right upper zone, in the collapsed area. The deviation of the trachea is again well brought out, and the cavity which was apparent in fig. 4 is now more clearly defined and the wall has assumed a more fibrotic type. Bifurcation of the left main bronchus is well seen. The small fibrinous attachment in the upper zone on the right side should also be noted.

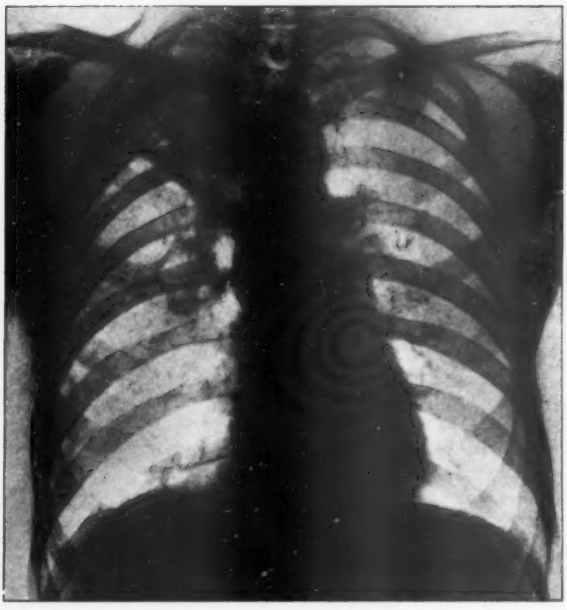

FIG. 6 (Case 2).—A relatively chronic tuberculous lesion affecting the right upper zone particularly, with a band of intrapleural thickening and cavity formation in the mid-zone, near the hilum on the right side.

FIG. 7.—The deviation of the trachea is clearly visible, and the presence of a cavity in the right upper zone is noticeable.

FIG. 8.—This section is taken half-way through the chest, and the loculation in the cavity shown in fig. 7 has now disappeared and is replaced by a protrusion into the wall of the cavity. This protrusion is undoubtedly part of the septum which is seen in fig. 7.

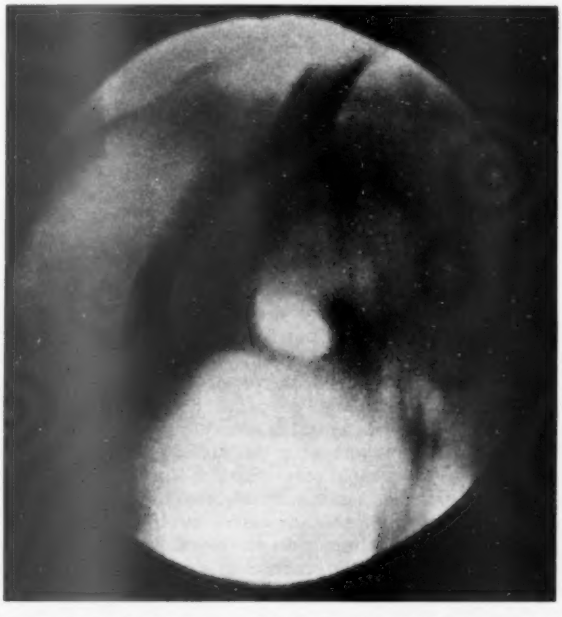

FIG. 9.—Showing the effect of placing a metal tube over the right upper-zone lesion and thereby obtaining greater detail. The increased penetration enables one to identify a smaller cavity towards the inner and lower side.

The cases which I have now shown are perhaps on the obvious side, but during the past twenty months or so we have been concentrating on cavity formation, with a view to determining the possibilities and potentialities of this new device in diagnosis.

That it is possible to trace the shape and size of cavities is not to be doubted. That we can obtain clear and distinct information concerning the nature of the cavity wall, and the tissues immediately surrounding it, has also been demonstrated; the relationship of the cavity to the bronchial tree has, I am sure, more than a mere academic interest. The more precise information concerning the intra-cavitary septa is surely an advance, and adds something new to the " pathology of the living "; but most important, perhaps, is the clear evidence of separate and distinct cavities which may exist, totally unsuspected, in the lung.

The advantage which tomography in lung conditions may be to the surgeon, for whom accurate localization may be all-important, will be appreciated; the device may even tell him of failure, in certain cases of thoracoplasty, to close a cavity, and may demonstrate the cavity in a mass of dense skeletal and pulmonary structures. The promise which tomography holds for elucidating those " hilar shadows " which may mean all or nothing need only be mentioned; and in our series we have been able, in a large number of cases, to separate and distinguish spontaneous pneumothorax from cavity, and—perhaps most important of all—we have been able by means of a tomogram to determine the absence of cavity formation where the usual flat films may have suggested its existence.

There are, of course, many features in tomography which give rise to great difficulties in interpretation, but experience will no doubt enable us to become more dogmatic on many features which are at present obscure. I am sure Dr. Twining will join with me in issuing a warning to the effect that we must still regard tomography as a very young, if somewhat precocious, child; but there is little doubt that the boundaries of radiological investigation, and especially of clinical chest medicine, have been expanded by the advent of this new device.

Personally I share the view expressed recently by Dr. Kerley (1937), to the effect that the next four years will probably see tomography universally employed in practically all branches of radiology.

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Dr. E. W. Twining: To the radiologist the new method of X-ray examination known as " tomography " presents some interesting possibilities, and offers a solution of some difficult daily problems. It provides also a stimulus to the study of three-dimensional anatomy in the living subject, for, obviously, this cannot be carried out successfully and economically unless the depth from the surface of the structure to be examined is known with considerable accuracy.

I do not think that any elaborate apparatus is essential for tomography. My own apparatus (fig. 1), a very simple one, which I constructed, is not perhaps fully equivalent to the expensive apparatus which has been made in Germany, but it serves to demonstrate that tomography can be satisfactorily performed by simple means. It is essentially an attachment to the usual X-ray couch, and consists of a lever connecting the tube to the film-carrier in such a way that the image of an object in any desired plane is held steady on the film during the movement of the tube so that its shadow is sharply defined while those of other structures are blurred.

The lever has an adjustable axis by means of which any desired plane can be selected. The apparatus can be attached in less than a minute to the couch when it is desired to perform tomography. Another type of demountable tomographic attachment suitable for most radiographic couches is being made for me by a firm of manufacturers, embodying my suggestions.

FIG. 1.—Simple attachment for tomography.

The value of the method depends upon two factors: (1) The abolition of a multiplicity of confusing details of superimposed structures, (2) the gain in *contrast* which results from the attenuation of the shadows of superimposed dense structures.

The latter is illustrated by a simple experiment: A small coin is invisible in a radiogram if a larger or thicker coin be interposed between it and the X-ray tube; in a tomogram, however, the larger coin disappears and the small coin is shown alone. The disappearance of the larger coin is due to the diffusion of its shadow, which becomes spread out over a larger film area, because it moves faster than the film. This gain in contrast makes it possible to show by tomography thin cancellous bones which are usually hidden by thicker bones; thus the patella, the sterno-clavicular joints, the temporo-mandibular joints, the zygoma, the atlas and axis (through the closed mouth), the nasal sinuses, the facial bones and the cribriform plate, can be displayed much better by this method than by the usual routine methods. Intracranial calcifications which are too delicate to be seen clearly in the plain film, for example faint calcification in a pineal tumour, can be shown by tomography.

I have also found it useful in ventriculography, particularly to show the 3rd ventricle. The abolition of the confusing shadows of air in the temporal horns and in the cerebral sulci, together with the enhanced contrast of the 3rd ventricle itself, lends distinct value to the method. (Examples of the uses of the method in bone- skull- and spine-work were shown.)

FIG. 2*a*.

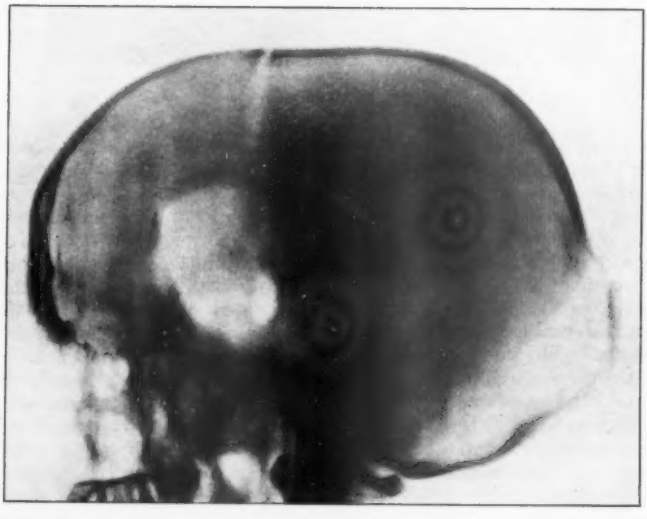

FIG. 2*b*.

FIG. 2.—Skull. Calcified suprasellar cyst containing air. (*a*) Plain film. (*b*) Tomogram.

FIG. 3*a*.

FIG. 3*b*.

FIG. 3.—Skull. Ventriculogram ; (*a*) Plain film. Third ventricle not shown. (*b*) Tomographic ventriculogram in same position. The third ventricle is now clearly shown. (Taken in median plane.)

Though the gain of contrast is considerable, there is inevitably some loss of detail, most noticeable in the cancellous structure of bone; the method is, therefore, a compromise. The reason for the loss of detail is illustrated by the following experiment: If a tomogram be taken of a row of lead shot arranged on a board above the couch so that each shot is one-eighth of an inch further from the couch than the one preceding it, the film will show the shot in the selected plane to be sharp, those on either side of that plane very slightly blurred, and the next in order appreciably blurred. The blurring of the other shot increases progressively according to their distances from the selected plane. There is, in fact, no absolute thickness of stratum in which the definition is perfect, so that when we state that the thickness of stratum included in the tomogram is 0·5 cm., what we really mean is that within that thickness the blurring is tolerable to the eye. The blurring, however, in the region on either side of it is sufficient to destroy to some extent the bony detail.

Tomography of the lungs.—Dr. McDougall has, I am sure, convinced you this evening of the value of tomography in the detection and study of cavities in pulmonary tuberculosis. My own material has given me equally convincing evidence. I have tomograms showing undoubted cavities which were invisible in the plain radiograms, and in several cases in which cavitation was shown by the normal method the tomograms brought to light further unsuspected cavities. It is not necessary for me to show examples of these, but I should like to refer to the interesting question which Dr. McDougall has raised concerning the nature of the projections into the cavities which he has suggested may be septa. I feel sure that this is the right explanation. The pathological specimen (fig. 4) illustrates the point. In the upper lobe is a series of

FIG. 4.—Tuberculous cavitation showing septa.

communicating cavities of 2 to 3 cm. in diameter. Their lining is comparatively smooth and vascular and their walls are thick and fibrous, showing several smooth raised ridges. Openings to the bronchus are indicated by styles. The cavities are lined by vascular granulation tissue with occasional tuberculous foci and patches of caseation. The patient was a man aged 24 who gave only twelve months' history of cough and headache, and three months' history of hæmoptysis. He died of tuberculous meningitis.

It is clear that a tomographic section through these cavities would produce an appearance of projecting septa, such as Dr. McDougall has described.

Similar projections have been seen in cases of abscess in my series illustrated in fig. 5 *a* and *b*. The patient, a woman, aged 35, was admitted to hospital with a

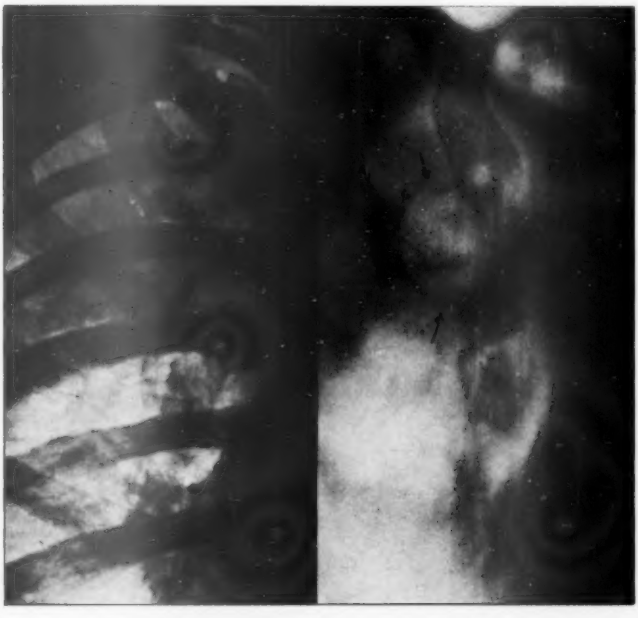

FIG. 5*a*. FIG. 5*b*.

FIG. 5.—Abscess of lung. (*a*) Plain radiogram; abscess not shown. (*b*) Tomogram: abscess cavity clearly shown; walls sharply defined; cavity divided by septa.

definite clinical history and evidence of an abscess following tooth extraction. The abscess was seen in a plain film (erect) showing a fluid level 2 in. from the front of the chest in the right upper lobe. A plain film taken in the prone position (fig. 5 *a*) showed no evidence of a cavity, but a tomogram in the same position showed it clearly. It was bilocular, with a septum projecting inwards from its outer wall. A further section, half an inch further back, showed the septum even more clearly, and a second shadow near the bottom of the cavity which might have been a tooth, but was interpreted as the cross-section of a tongue-like septum projecting forwards. This was verified by operation; the abscess was opened and contained no tooth. Further tomographic studies were made after operation and drainage of the cavity,

which proved very useful in following its progress, for it was not visible in plain radiograms. Tomograms showed the operative defect in its outer wall and the gradual disappearance of the cavity, the septa becoming less prominent. They were evidently structural entities and not artefacts.

Malignant abscess.—Tomography has been useful in differentiating cavernous neoplasm from abscess. Cavernous neoplasm may show several types : (*a*) A central hole in a massive nodule or infiltration. The wall is thick and its margin irregular. In the tomogram nodules of growth can be seen projecting into the cavity ; (*b*) the cavity may be due to the breaking down of an area of pneumonitis adjacent to the actual growth. Its walls are then composed of infective lung tissue and it may be indistinguishable from any other abscess cavity. There may, however, be a malignant gland or peribronchial mass projecting into the medial side of the cavity. This type of cavity I call " para-malignant ". The following case presents the features of type *a* :—

J. P., male, aged 64, admitted to the Manchester Royal Infirmary under Mr. Graham Bryce.

26.5.37 : Cough, pain and hæmoptysis—never profuse—for three months. Wassermann reaction negative. No tubercle bacilli. Some loss of weight but recent gain. On examination, dullness at left apex with prolonged expiration.

28.5.37 : Plain film. Cavity 2 inches from anterior chest wall, fluid level. The wall showed nothing characteristic, but doubtful bronchial gland projecting into its inner side. The tomogram (fig. 6 *b*) showed the cavity to have a crenated edge with nodules

FIG. 6*a*. FIG. 6*b*.

FIG. 6.—Malignant abscess. (*a*) Plain radiogram. The abscess can hardly be seen ; there is a projecting nodule in the left hilum. (*b*) Tomogram. Abscess clearly shown ; walls irregular ; nodule projects into lower part of abscess cavity.

projecting into the lumen; these nodules were constant in subsequent tomograms. On the medial side a shadow, closely applied to the left pulmonary artery, projected into the lumen. Outside the cavity was an opaque area which faded off into the lung, subsequently shown at operation to be due to the infiltrated edge of the tumour, which reached the pleura and invaded rib. Above the opaque area were some translucent, oval areas of emphysematous lung.

29 5.37: Bronchoscopy showed swollen injected mucous membrane in the upper lobe and stem bronchi, which did not look definitely neoplastic. The sputum contained Friedländer's bacillus, streptococci and staphylococci. Further tomograms during the next two months showed little change. They were thought to be definitely indicative of malignancy. Operation was undertaken, however, in the hope that the condition might be one of simple abscess. Diagnosis of malignancy was confirmed.

Chaoul and Greineder believe that the difference between malignant and non-malignant abscess can be diagnosed tomographically from observation of the shadow surrounding the cavity, which in malignant disease is homogeneous but shades off into the lung and often shows projecting processes and strands; in abscess, on the other hand, it is said to be mottled, owing to the presence of small cavities and patchy lobular infiltrations. I have not yet been able to verify this, but I think that the demonstration of nodules projecting into the lumen is strong presumptive evidence of malignancy.

Tomography of the pulmonary vessels.—It has been shown by Chaoul and Greineder that the pulmonary vessels are brought out very clearly by tomography. This has enabled them to make a valuable study of the anatomy and relations of the pulmonary arteries and veins in the living lung. It has long been known that the vessels—in particular the pulmonary arteries—are the principal causes of the lung arborizations, the walls of the bronchi playing little part. Bronchi, arteries, and veins are very clearly shown as independent entities in tomograms; the veins in the hilum are widely dissociated from the arteries, the bronchi taking an intermediate position. The method, therefore, is of considerable value in sorting out the components of the hilar shadows. Further, as has been shown by Sopp, enlarged lymphatic glands can be differentiated from the vessel structures in tomograms, a fact which I have been able to verify in cases of malignant disease and lymphadenoma. There is also considerable practical value in the identification of the pulmonary vessels in cases of fibrosis and atelectasis. In localizing a lesion to its correct lobe or part of a lobe, we must sometimes rely upon this identification unless the interlobar fissures are clearly visible. If we can see and identify the individual vessels and know their normal distribution and course, we can often decide which lobe or part of a lobe is collapsed or consolidated, and can sometimes differentiate between a lobar lesion and an interlobar effusion. The method is particularly applicable to the differential diagnosis between middle-lobe collapse—a frequent condition in children—and encysted effusion in the lower part of the main interlobar fissure.

I have also applied this method to a case of coarctation of the aorta in order to show the point of narrowing of the aorta, which by ordinary radiography is extremely difficult. The tomogram taken in the second oblique position (fig. 7) shows an abrupt cessation of the shadow of the aortic arch at the point of stenosis.

Tomography of the bronchi.—In studying some of the early tomograms which I made of the lungs, I was struck by the clarity with which the trachea and larger bronchi stood out from the background of the mediastinal shadow whenever they lay in the plane of section. It occurred to me that the increased contrast which tomography affords might be used to show the actual site and degree of bronchial stenosis in cases of bronchial carcinoma, without employing lipiodol. The first attempt on these lines was quite successful. The patient, a man aged 54, was admitted to the Christie Hospital with symptoms of left-sided carcinoma. Plain films showed marked opacity of the left lower lung field, lower lobe collapse, with mediastinal displacement towards the left side. A tomogram showed the tracheobronchial bifurcation, normal right main bronchus and its branches; the left bronchus ended abruptly about one inch from the bifurcation (fig. 8, *a* and *b*). A diagnosis of bronchial

FIG. 7.—Co-arctation of the aorta. Tomogram showing: The abrupt stenosis of the aortic arch; the left pulmonary artery; the tracheal bifurcation; the left lower lobe bronchus.

FIG. 8*a*. FIG. 8*b*.

FIG. 8.—Bronchial carcinoma. (*a*) Plain radiogram. Chest opaque owing to effusion. (*b*) Tomogram. Complete obstruction of right bronchus by carcinoma.

carcinoma at this site was made. Bronchoscopy confirmed the diagnosis; a tumour was found blocking the right bronchus one inch from the carina. Subsequent investigation of a series of 12 cases of suspected bronchial carcinoma was therefore made. All of these cases showed opacity in the affected hemithorax varying from a limited hilar mass to total opacity due to effusion. In no case could the bronchial obstruction be seen in the plain film (fig. 9). By tomography, however, it was possible to show the bronchi even in the presence of massive effusion, and a positive diagnosis of bronchial obstruction was made, and the site of obstruction demonstrated in 10 cases. Of these 10 cases, confirmation was obtained in seven (lipiodol three, bronchoscopy three, post-mortem one), and in the remaining

FIG. 9.—Malignant bronchial stenosis. The plain film showed complete opacity of the left hemithorax. The print is from a tomogram taken in the plane of the main bronchi. It shows complete stenosis of the left main bronchus.

three the diagnosis is not in doubt. Of the two cases reported negative, one was confirmed by post-mortem examination, the patient having died of pneumonia; the other case was reported as non-malignant distortion of the right upper-lobe bronchus due to fibrosis. This was confirmed by comparison with radiograms taken three years previously, showing gross apical fibrosis, by the fact that there had been no change in the meantime, and by the subsequent course of the case.

I am convinced that tomography is of undoubted value in these cases and it should, I think, always be tried as an alternative to lipiodol and as a preliminary to bronchoscopy, for it gives most useful indications.

Tomography of the drainage bronchus in abscess.—In a few cases of lung abscess it has been possible to show the drainage bronchus of the affected segment very clearly by tomography. In one case the bronchus supplying the apex of the left lower lobe was found in a lateral tomogram to be dilated and to run into a small cavity in that

segment of the lung. This finding was confirmed post-mortem. In another case the cavity lay in the middle lobe and the drainage bronchus could be traced right up to the cavity. This procedure has, I think, some value in the differentiation of abscess from peripheral carcinoma with cavitation, for, in the latter condition, we should be unlikely to find an unobstructed bronchus reaching right up to the cavity.

To conclude: Tomography is still in an experimental stage, and all that can be said about it at the moment is that it is a valuable addition to our resources. Even if it could accomplish nothing more than the detection of cavities in the lung, it would have earned its place, but it also has attractive possibilities in other fields and, as cheaper apparatus becomes available, it is likely to come more and more into routine use. It is obviously unsuited for wholesale use, but if we ask it the right questions we shall get the right answers.

[Figures 5, 6, and 8, are reproduced by permission of Messrs. H. K. Lewis.]

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Dr. Charles Colyer said that he wished to suggest a modification of the technique of tomography so far adopted—at any rate in this country—which he thought would increase its clinical value, especially in cases of pulmonary tuberculosis and possibly of lung abscess.

The vertical position for tomography had several advantages, besides that of showing fluid levels. It was much easier to put the patient in position, especially for the lateral view; moreover, patients were much more comfortable when sitting than when lying flat on a couch. In addition, a cavity containing a large proportion of fluid might be missed when the patient was tomographed in the horizontal position.

He also wished to point out the importance of the lateral tomogram as had been illustrated by skiagrams of a case in which a thoracoplastic operation had been performed (referred to him by Dr. F. H. Young). A simple skiagram had not shown the condition of the lung at all, nor had a series of antero-posterior tomograms helped much more, but a lateral tomogram, taken vertically, had clearly shown the cavity, which appeared to contain a small quantity of fluid.

[Dr. Colyer showed a series of lantern slides illustrating his points.]

Dr. Philip Ellman said that he had been impressed by the tomogram of coarctation of the aorta shown by Dr. Twining. The stenosis beyond the aneurysmal dilatation was so clearly marked that he wondered whether Dr. Twining had used tomography for the examination of the aorta in various cardiovascular conditions, especially in the second oblique position. Its use here might prove to be of great value.

In view of the clear picture of the blocked bronchus in the cases of carcinoma of the lung shown by Dr. Twining, he (the speaker) thought that the use of the tomograph in bronchiectasis, especially of the atelectatic type, might be of special value, and obviate the necessity for bronchography. The introduction of lipiodol into the tracheobronchial tree was not a simple matter in the out-patient department. Tomography, if it showed clear evidence of bronchial dilatation, should therefore add greatly to the simplification of the diagnosis of bronchiectasis, although doubtless it could not replace bronchography in this condition.

Dr. Cochrane Shanks asked Dr. Twining if he had found tomography of any value in the examination of opaque gall-stones or in intravenous urography.

Dr. Twining (in reply): In a recent case of a suspected gallstone in a stout patient tomography proved of distinct value. The shadow was of the ring type, and very faint. It could not be shown in the lateral view. Tomograms taken with the patient prone picked up the gall-stone and showed it to lie anteriorly, at gall-bladder depth. Its contrast was greater in the tomograph than in the plain plates. I have not used tomography in intravenous pyelography or in cholecystography.

Section of Odontology

President—FRANK J. PEARCE, L.D.S.E.

[*October* 25, 1937]

A Case of Acute Myeloid Leukæmia

By EVELYN SPRAWSON, M.C., D.Sc., M.R.C.S., L.D.S.E.

ON April 1, 1937, S. G., male, aged 37—a railway fireman on a night shift—noticed a slight swelling on his face, over the left side of the mandible. There was no pain and the inside of the mouth felt normal.

On April 3 he noticed an irritating sensation in the gums, in the region of the mandibular left first permanent molar. His appetite began to diminish, and he vomited on taking food ; he felt ill and did not go to work.

On April 4 the mandibular gum was swollen ; the margins round the teeth were dark in colour, and there was a brownish sanious discharge from them. The patient felt tired and attributed the feeling to loss of sleep.

On April 5 the swelling over the mandible increased and the gum on the left side of the maxilla began to be affected. He was referred to a dental surgeon who saw him about 10.30 a.m. The mandibular left second premolar and first permanent molar were found to be loose and there was a swelling over the buccal aspect of the adjacent gum and bone, resembling an alveolar or parodontal abscess. The swelling was not discoloured, and with the exception of the last molar, the teeth were not carious. An appointment was made for the extraction of these teeth, at 2.30 p.m. on the same day, but by that time a profound change had taken place, and the mandibular swelling was becoming black, so the patient was referred immediately to the London Hospital and attended the Dental Department next morning (April 6).

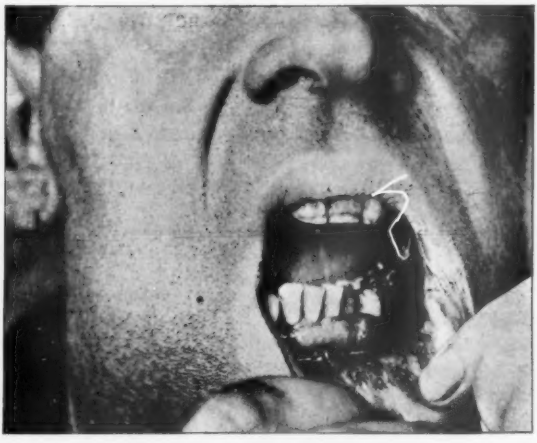
The gingival margin around all the mandibular teeth was greyish-blue and necrotic, but the main mass of the gum was normal in colour, except on the buccal aspect of the left side of the mandible where the swollen portion was black. The gum margin round the maxillary left teeth was also affected, but not so severely.

There was no pus or discharge at that time, and the patient disclaimed any feeling of lassitude, except such as he would have expected after two days' broken sleep. He looked ill, but not anæmic or cyanosed. The unaffected portions of the gums—and also the lips, mucous membranes, and face—were of a good colour ; all the teeth were rather mobile, as in advanced parodontal disease, the breath was offensive, and the swelling on the mandible was tender to pressure. There was no enlargement of glands, nor were there any hæmorrhages on the body.

The past history did not disclose anything relevant. Blood-count (6.4.37) : Erythrocytes 3,900,000 ; Hb. 80% ; C.I. 1·02. Leucocytes 53,600 (poly. neutros. 12·5% ; poly. eosinos. 0·5% ; small lymphos. 4% ; large lymphos. 11·5% ; large hyals. 0·5% ; myeloblasts 71%). Platelets very scanty.

The temperature was 102° F. and the pulse-rate 120. The patient was therefore admitted into hospital, where his spleen was found to be palpable two inches below the costal margin.

A further blood-count showed an increase of myeloblasts to 76%, and a reduction of hæmoglobin to 67%. Blood-count (9.4.37): Erythrocytes 3,300,000; Hb. 67%; C.I. 1·03. Leucocytes 91,500 (poly. neutros. 0·5%; small lymphos. 6%; large lymphos. 7%; large hyals. 4·5%; transitional neutros. 2%; neutrophilic myelocytes 3·5%; myeloblasts 76%). Slight poikilocytosis and anisocytosis. Cultures from the gum margin disclosed nothing relevant.



S. G., 7.4.37. Acute myeloid leukæmia.

The patient died on April 10, of bronchopneumonia. The black area on the buccal aspect of the gums had then extended freely on to the adjacent cheek.

The illustration shows the appearance on the day after admission.

[A specimen taken from the left molar region was shown.]

[*November* 22, 1937]

Infection of the Salivary Glands

By Reginald T. Payne, M.S., M.D. F.R.C.S.

In view of the wide nature of my subject, I propose to confine myself to a consideration of pyogenic infections of the salivary glands and to exclude the chronic infections due to tubercle, syphilis, and actinomycosis, and the virus infections such as mumps. Many of the infections of the salivary glands are secondary to dental disease and many cases closely simulate dental disease. The newer methods of investigation have enabled this branch of stomatology to be approached along more exact lines, with consequent greater accuracy in diagnosis and treatment.

The present paper is based upon a series of 208 cases of infection of the salivary glands (117 parotid; 91 submaxillary) which have come under my personal care or observation.

[The comparative anatomy and development of the salivary glands, and their main anatomical, histological, and physiological, features were then described.]

Special Methods of Investigation

In addition to the clinical examination of the salivary glands, special methods of investigation should be carried out in cases where these are indicated. These should include examination of a canula specimen of saliva from the gland to be investigated, and its subsequent cytological and bacteriological study. Examination of this saliva for the ptyalin content is hardly of more than academic interest. Careful radiological examination should be carried out in all doubtful cases, and may reveal unexpected opacities. The interpretation of these pictures is not always easy. Sialography by means of the injection of lipiodol or other substances may prove of extreme value in determining the anatomical configuration of the duct system of the glands, particularly in cases associated with any degree of retention of salivary secretion.

Infection of the Parotid

The parotitis cases in the present series were distributed as follows :—

Acute parotitis	54 (males 33 ; females 21)
Recurrent parotitis	52
Chronic parotitis	11
Total	117

It is not always easy to decide into which of these categories any given case should go. As far as possible, however, cases have been considered to be (1) Acute, when the patient came under observation in the first attack and in which pain and swelling were characteristic features. (2) Recurrent, when the symptoms were definitely of a recurrent nature and associated with intervening periods of freedom. (3) Chronic, when the infection persisted, did not become acute, and did not exhibit a clinical periodicity. Some degree of overlapping of these various types of case has, however, been unavoidable.

(*A*) *Acute Parotitis*

Acute parotitis is a condition which may at times be initiated by the patient's neglect of oral hygiene ; it is one which in the past was frequently due to the negligence of all hygiene in the post-operative period or during treatment which involved oral starvation, and it is still a condition in which delay in treatment only too often allows the surgeon to wait with folded arms for the signs of abscess formation, or, should these fail to appear, to carry out some minor operation which does little to relieve the underlying parotitis. Nevertheless, as a complication of a variety of diseases, acute parotitis is still met with in a sufficient number of cases to make its ætiology, pathology, and treatment, worthy of study. For, if the pathological processes which lead to gross suppurative changes are understood, treatment based on this knowledge will, if carried out towards the beginning of the disease, frequently prevent its progress and avoid the necessity for operative measures.

Ætiology.—Theoretically, infection may reach the parotid by three routes : by the blood-stream, as an ascending infection via the duct, or by direct extension from adjacent organs. The evidence is conclusive that in practically all cases pyogenic parotitis is ascending in origin and that the other routes of infection are rare.

Hæmatogenous parotitis : Infection of the parotid gland of a septicæmic or pyæmic nature is so uncommon as to render it a pathological curiosity. If hæmatogenous infection does occur, the lesion must be in the nature of an interstitial,

suppurative parotitis starting in the region of the small blood-vessels and extending secondarily to the glandular tissue, a type of lesion which in practice is not found. Although patients with septicæmia or pyæmia do at times develop acute parotitis, it is invariably of an ascending type, and this is supported not only by the histological evidence but by the frequency with which the *Staphylococcus aureus* is the infecting organism in the parotid, irrespective of the organism causing the septicæmia or pyæmia. For example, although parotitis is quite often met with during the septicæmic stage of typhoid fever or during the course of pneumococcal infections, it is seldom due to their specific micro-organisms.

Direct infection : Parotitis occasionally results from the spread of infection from adjacent tissues. This may be of the nature of an acute cellulitis, an acute lymphadenitis or an acute osteomyelitis of the mandible. In all such cases, the infection reaches the parotid through lymphatic channels.

Ascending infection : Acute infection of the parotid is in nearly every case an ascending one, no matter whether it occurs as a post-operative complication, during the course of a specific fever, as a terminal infection, or in patients taking very little food by mouth. It is a matter of some dispute whether micro-organisms are present in the terminal part of the parotid duct. If, for any reason, the virulence or the number of the micro-organisms present in the region of the duct orifice is increased, or, on account of obstruction in the terminal part of the duct, the amount of saliva secreted by the patient is seriously diminished, or the general resistance to disease markedly lowered, ascending infection occurs. Saliva is a poor culture medium for the majority of pyogenic bacteria but, in health, it is probable that the constant flow along the duct possesses a more important mechanical function in preventing ascending infection than any inherent bactericidal action.

From the point of view of clinical ætiology, the following are the most important conditions during the course of which acute parotitis may arise :—

(1) Post-operative—especially after abdominal operations.
(2) Acute specific fevers—especially typhoid, typhus, and lobar pneumonia.
(3) Any cachectic condition—as a terminal infection.
(4) Oral starvation—as after hæmatemesis.
(5) Insanity.
(6) Secondary to duct obstruction.
(7) Secondary to buccal infections.

In a series of 1,000 cases of hæmatemesis recorded by Rolleston and Oliver [1] which had been treated by oral starvation, parotitis occurred in 23.

The recent observations of Christiansen [2], who found that death after massive hæmorrhage from gastric ulcers was due to extrarenal uræmia, would suggest that in many cases at least, parotitis may be considered as possibly a uræmic manifestation.

In the present series of 54 cases, ætiological factors were present in 42. The details are given below :—

Local :—

Dental infections or dental extractions	6
Dental plate	1
Colds	2
Pneumonia	2
Radon to carcinoma of cheek ...	1
Nasal catarrh	1
Post-recurrent or chronic parotitis ...	2
Parotid calculus	2
During meal	1
Tonsillitis	1
Impetigo	1
	20

General :—

Hæmatemesis	6	
Post-operative	2	
Acute infections:		
Septicæmia	1	
Pyæmia	4	
Blood diseases (aleukæmic leukæmia)	1	
Chronic duodenal ulcer	1	
Diabetes and hepatitis	1	
Fatigue	1	
Bacillary dysentery	1	
Acute nephritis and uræmia ...	1	
Whooping-cough	1	
Measles	1	
Post-vaccination	1	
	——	22
Total		42

Macroscopic and microscopic pathology.—Pyogenic parotitis is essentially a process starting in the distal third of the duct. In the earliest stage, this consists in the multiplication of micro-organisms followed by catarrhal inflammation of the duct with increased secretion of mucus, desquamation of cells, and invasion of leucocytes. These organisms, pus cells, and desquamated epithelial cells, may form a plug which acts as an obstruction to the free exit of saliva into the mouth, the so-called salivary thrombus. Consequently, at this stage, there is a damming back of saliva, with dilatation of the ducts and acini. The way is then paved for the development of an ascending infection which eventually reaches the finer ducts and acini of the parotid.

The earliest changes are of a catarrhal nature, but if the obstruction to the main duct still persists, or if the organisms are very virulent or the patient's resistance is low, suppurative changes occur. These changes are most marked in the regions of the smaller ducts or the alveoli, and in both these situations the formation of minute abscesses takes place. The next stage of the disease consists in the fusion of many of these small abscesses with the development of single or confluent abscesses. Hitherto the pathological process has been confined within the capsule of the parotid, but if softening takes place, perforation in one of several different directions may follow.

In addition to the above changes, necrosis of more or less of the parotid glandular tissue may occur, depending upon the virulence of the infection and the rapidity with which distension inside the gland capsule takes place. Occasionally, this process is so acute as to convert the whole gland into a slough, a condition which has been described by Cope [3] as acute necrotic parotitis.

The majority of the patients who come to post-mortem show some associated serious disease which might in itself be of sufficient severity to cause death. The parotid glands from these patients are always grossly enlarged and riddled with small abscesses. Microscopically, these abscesses are found to begin in the smaller ducts, whilst the larger ducts are distended with pus and micro-organisms.

A consideration of the gross anatomy and histology of such parotids suggests that the term " carbuncle of the parotid " is not inappropriate, since the lesion is essentially of the same type as two other important staphylococcal lesions, namely, carbuncle of the skin and carbuncle of the kidney.

Bacteriology.—By far the commonest organism found in acute parotitis is the *Staphylococcus aureus*, with the *Streptococcus viridans* as second in order of importance. In addition to these, other organisms which have been found include hæmolytic streptococci, typhoid bacilli, coliform organisms, pneumococci, and

Bacillus fusiformis. Bacteriological examinations were carried out in 38 out of the 54 cases of acute parotitis in the present series, and the following results were obtained :—

Staphylococcus aureus ...	25
Streptococcus viridans ...	5
Streptococcus hæmolyticus	2
Pneumococcus	4
B. coli (atypical) ...	1
B. fusiformis	1
Total	38

Professor Seifert [4] has carried out some interesting and instructive experiments in connexion with the striking predominance of the *Staphylococcus aureus* in acute infections of the parotid. These experiments consisted in the bacteriological examination of saliva from the region of both parotid and submaxillary ducts in patients during the pre- and post-operative periods. As a result of the examination of material from 90 cases, the majority of whom had had abdominal operations, Professor Seifert [4] showed that during the post-operative period there was an exaltation of the *Staphylococcus aureus* content in the mouth, at the expense of other organisms. Although in health staphylococci play a very subsidiary rôle, in the post-operative period they are markedly increased. This increase lasts for three or four days and then falls to normal. The degree of the increase was most marked in cases in which fasting was necessary, or in which the mouth was dirty before operation or in which little care was taken of the mouth after operation. In patients who were extremely ill, the number of staphylococci continued to increase until death. Amongst the cases examined, two developed parotitis. In one of these the parotid had to be drained and staphylococci were found in the pus, and in the other the condition subsided without suppuration. At the same time, Professor Seifert [4] showed that the increase in the number of staphylococci was usually much greater in cultures taken from the mucin-free region of the parotid duct than from the vicinity of the submaxillary ducts, where large quantities of mucin would be normally present. More recently, this investigator has shown that there is an increase in the staphylococcal content of the mouth during all conditions of drying of the mucosa, whether in healthy or in unhealthy subjects. This work appears to be a further link in the chain of evidence that post-operative parotitis, or that associated with any condition of dehydration, is always an ascending infection and, further, that the absence of mucin from the parotid saliva may be an important factor with reference to the frequency with which infection of this gland takes place, compared with infection of the submaxillary gland.

Acute parotitis should therefore be regarded as usually a staphylococcal infection, and the more acute the condition the more likely is this to be the case. This is true where the disease develops as a post-operative complication during the course of an acute specific fever, following a hæmatemesis, or during the septicæmias associated with typhoid fever and pneumonia.

Clinical types.—The various pathological processes occurring in ascending infection have already been described, but from the clinical aspect it is difficult to demarcate these stages accurately. This difficulty is increased by the fact that whilst in some cases the disease develops comparatively slowly, in others it is characterized by the rapidity with which one stage passes into the next. With the foregoing reservations, however, the following classification may be of some value : (1) Catarrhal. (2) Suppurative. (3) Suppurative, with intracapsular abscess formation. (4) Suppurative, with intra- and extra-capsular abscess formation. (5) Necrotic or gangrenous.

Although the foregoing stages of the disease do occur, it must be remembered that in cases terminating fatally the condition is a diffuse suppurative lesion involving the whole gland. The necrotic or gangrenous type cannot be regarded as a normal end-result in acute parotitis, but rather as the type in which the intervening stages have been passed over and necrosis occurs without abscess formation.

Catarrhal parotitis : At this stage, there is local pain, usually in the region of the angle of the jaw or actually in the ear itself, accompanied by slight local swelling, a moderate degree of fever, and a corresponding increase in the pulse-rate. The parotid gland is visibly enlarged within its normal anatomical boundaries, and a little

FIG. 1.—Acute suppurative parotitis, secondary to severe pyorrhœa. The gland was drained externally and the pus contained a pure growth of *Staphylococcus aureus*.

tender on pressure, but the overlying skin is normal. At times, the orifice of the parotid duct shows congestion, and pressure over the gland may produce mucopus.

Suppurative parotitis (figs. 1 and 2) : This stage is characterized by a much greater degree of parotid enlargement, by the exquisite tenderness of the gland, and by the presence of œdema which may extend to the eyelids. Pus may or may not be seen issuing from the duct, but the extremely painful condition of the gland often renders it impossible to carry out prolonged pressure. Constitutional disturbance is generally severe, and delirium may be present, together with a considerable degree of fever. In some patients with this type of parotitis the clinical picture may, however, be an adynamic one, associated with a subnormal temperature.

It is not, as a rule, possible to determine when the stage of suppurative parotitis passes into that of an intracapsular abscess, but an extracapsular abscess, particularly when it develops in its typical situation near the lower and anterior part of the gland, is easily recognized.

Complications.—Parotid suppuration may, in cases of a fulminating type, or where treatment has been delayed, extend beyond the limits of the capsule. Usually this extension is into the subcutaneous tissues, the region near the angle of the jaw being especially liable to be involved. Rupture into the external auditory meatus at the junction of the cartilaginous and bony portions is a fairly frequent route of discharge.

FIG. 2.—Acute parotitis and subcutaneous abscess. The parotitis was secondary to radium treatment of carcinoma of the buccal aspect of the right cheek. The capsule of the gland has ruptured in the lower and anterior part and given rise to a large subcutaneous abscess. This was drained, and the pus contained a pure growth of *Staphylococcus aureus*.

Complications arising from the extension of gross suppuration in the deep part of the gland are more serious in type but fortunately less common. Thus, pus may find its way into the lateral wall of the pharynx or track down the tissue planes of the neck into the mediastinum, it may burst into the temporo-mandibular joint, or even strip up the periosteum of the jaw and lead to necrosis. Rupture may also take place into the internal jugular vein or produce thrombosis in either that or the temporo-maxillary vein, and from such vascular lesions pyæmia or septicæmia may develop, or secondary hæmorrhage occur.

As a rare complication of acute parotitis, facial paralysis must be mentioned. This is likely to occur in the more acute forms of the disease associated with great swelling of the gland, and usually it is of a temporary nature, clearing up with the resolution of the parotitis.

In the present series of 54 cases, complications due to the extension of the infection into sites other than merely subcutaneous ones, and excluding the spontaneous discharge of pus into the mouth, occurred in five instances. In two of these, pus discharged into the external auditory meatus, in one into the pharynx and also into the sheath of the sternomastoid muscle, in one into the masseter muscle, and in one the parotitis was followed by the development of a chronic subcutaneous abscess and fistula in connexion with the buccal portion of the duct (fig. 3). In one other case, the patient developed a pre-operative left facial paralysis which subsequently cleared up. Necrosis of the mandible occurred in the patient with acute parotitis due to the *Bacillus fusiformis*, but the condition was almost certainly associated with the parotitis rather than secondary to it.

Remote complications of acute parotitis are unusual. Occasional cases occur in which the patient has more than one attack of acute suppurative infection, but

FIG. 3.—Healed parotid fistula. Showing scar at site of subcutaneous rupture of left parotid duct during course of subacute parotitis.

in such cases the possibility of a calculus being the ætiological factor cannot be disregarded. At times acute parotitis is the ætiological factor in the subsequent development of a recurrent type of parotitis. A case of this kind in a boy aged 11 is described later. An unusual complication recorded by Trioumphoff [5] in 1924, in a series of 14 cases, is local sweating and hyperæmia of the parotid region of the face following a recent parotitis. These changes may spread to the whole of the region of the auriculo-temporal nerve, to that of the third division of the 5th nerve and also to that of the great auricular nerve. They appear as soon as the patient begins to eat.

Parotid fistulæ, though they may occasionally follow external drainage of the

gland, never persist, owing to the acute inflammatory nature of the underlying pathological process.

Treatment.—It is not untrue to say that fomentations and procrastination have only too often formed the basis of the treatment of acute parotitis. Even to-day, fomentations frequently form the only bridge between the stage of onset and the stage where subcutaneous fluctuation demands surgical intervention. Such a policy not only endangers the patient's life, but may lead to the carrying out of operative measures which could often be avoided if adequate treatment had been employed from the commencement of the disease.

Treatment can only be considered in relation to the clinical background of the individual patient. Parotitis may be merely a local accompaniment of a duct obstruction, or be secondary to some buccal infection ; it may be a manifestation of dehydration such as occurs in the post-operative period, in acute specific fevers, and during oral starvation in the treatment of gastro-intestinal lesions ; it may be a manifestation of some serious blood disease ; it may result from direct extension of some local infection, and very rarely it may be a pyæmic or septicæmic metastasis. With such a diversity of possible ætiological factors as this, the first step in all cases must be the recognition of the clinical background in the individual patient. It is not proposed to discuss here the treatment of these associated diseases, or even to enter into the question of the general treatment of the patient, which is manifestly important in cases of acute parotitis.

The question of local treatment is complicated not only by the variety of clinical backgrounds to the disease, but also by the extreme variations which occur in the rate of development of the parotitis itself. Treatment in the early stages of the disease is non-operative, and should be instituted immediately the diagnosis has been made.

Non-operative treatment : All forms of acute parotitis start as a sialodochitis in the terminal part of the duct. If treatment is to be efficient and prevent the development of ascending infection, it must be designed to overcome this duct obstruction and to allow the pent-up salivary secretion to take its normal course. To achieve this, a variety of methods is available.

In the early stages of the disease, massage of the parotid is the most certain means of overcoming duct obstruction and of preventing accumulation of pus in the smaller ducts. This should be carried out systematically and always in a forward direction. It is easy to determine its efficiency, by examination of the duct orifice during the massage. It is unusual for any serious local extension of the disease to take place as long as the gland and its ducts can be emptied by this means, even though considerable quantities of pus can be expressed at four-hourly intervals over a period of several days. As a means of treatment in patients who are already seriously ill from some associated disease, massage of the gland is invaluable.

In those cases where massage fails, the probing or syringing of the duct may be necessary to effect the initiation of the flow of infected saliva into the mouth.

In all cases of acute parotitis the patient should be on a diet as solid as he can possibly manage. The act of mastication provides the most powerful stimulus to the secretion of saliva, and if the duct is still working the saliva will tend to dilute the infection and to wash it into the mouth. For similar reasons, the use of chewing-gum between meals is a valuable therapeutic measure in obtaining a steady flow of saliva. At the same time, the free use of acid drinks should be encouraged. The employment of heat in the treatment of parotitis not only relieves the local discomfort, but frequently hastens the appearance of discharge from the duct. Both external and internal forms should be used ; externally antiphlogistine or rubber hot-water bottles are best employed, and internally frequent hot mouth-washes should be given. The use of moist heat externally is to be deprecated as it produces the sodden condition of the skin which favours external rupture of the parotitis.

From the point of view of pharmacological treatment, it would appear that little benefit is to be expected from the use of drugs. In recent years, however, good results have been reported from Germany by the frequent use of " Neu-Cesol ".

Radiotherapy has been regarded as a method of treatment of parotitis by a few workers, but the results have not been very encouraging. I have not yet had any opportunity of carrying out treatment by means of short-wave diathermy in any case of parotitis.

Operative treatment : If treatment in acute parotitis is started early it may in many cases obviate the necessity for operation. Should, however, non-operative measures fail, or should the patient only come under observation at a comparatively late stage, treatment on surgical lines becomes essential. The fact that the parotid gland is enclosed in a dense sheath of fascia makes it difficult to determine the stage of the underlying infective process. A consideration of the question of the indications for operative treatment is best approached by dealing firstly with those cases in which surgery is not indicated, secondly by dealing with those in which surgery is imperative, and thirdly by considering those, falling between the two previous groups, in which surgery may or may not be required. The first of these groups comprises mild cases of parotitis with slight constitutional disturbance, in which discharge may take place either spontaneously or, following massage, through a patent duct. The second group comprises the cases in which an extracapsular abscess is present, usually subcutaneous, at the time when the patient first comes under observation. In this group, there is no doubt about the necessity of immediate operative treatment. With regard to cases falling in the intermediate group, however, the indications for operation are much less definite and must be considered in the light of underlying pathology and of any associated disease from which the patient is suffering. The anatomical configuration of the duct system of the gland favours the rapid spread of the disease, as does the poor general condition of many of the patients. In this group, the question of the patency of the duct is of great importance. If the duct is not patent and a discharge of pus through it cannot be produced by massage of the gland, and if such a state of affairs persists for more than twenty-four hours, operation becomes urgent. On the other hand, the presence of discharging pus through the duct orifice means that a safety-valve exists which may, if the general condition of the patient does not encourage surgical treatment, permit the possibility of delay. It must be remembered, however, that it is not always possible to distinguish between the merely suppurative stage of the disease, which may resolve without external operation, provided the duct is patent, and the stage at which the disease has progressed to a confluent intracapsular abscess, in which case spontaneous resolution in the presence of a patent duct is much less likely to occur.

In those cases of acute parotitis in which operative treatment is indicated and in which the physical signs do not suggest the presence of any merely localized collection of pus, the free exposure of the parotid gland is essential. Any operation designed to secure this must provide a wide exposure of the surface of the gland, it must be followed by the division of the parotid fascia in several places, in the line of the branches of the facial nerve, together with the opening up of the deeper part of the gland, and in view of the situation of the lesion, the question of resulting scarring has to be borne in mind. For this purpose, the incision advocated by Lilienthal [6] appears to be the most satisfactory (figs. 4 and 5). This incision begins just in front of the external ear, at the level of the zygoma, passes downwards in front of the ear in the slight furrow between this and the face, and then, curving just below the angle of the jaw, passes forwards to end at the anterior border of the masseter muscle. The flap of skin, together with the subcutaneous tissues, is dissected forwards, exposing the lateral aspect of the parotid gland, and if necessary, the posterior flap can also be dissected backwards. By this means, the lateral aspect of the enlarged parotid gland is displayed. A series of five or six radiating incisions

in the line of the facial nerve is made, varying in length from ½ in. to 1 in., and through these Spencer-Wells forceps are introduced and the deeper part of the gland opened up. The individual incisions are then packed with gauze soaked in flavine and the superficial part of the wound is similarly treated.

In operating on cases of acute parotitis by this means, it is invariably found that the capsule of the gland is thickened as a result of œdema, and that as soon as this has been incised, the subjacent parotid gland prolapses through the incision. It is further found that in the majority of cases no gross collection of pus is encountered but that minute beads of pus, together with watery fluid, exude diffusely from the gland substance. This finding, although disappointing to the surgeon who would prefer to find a large purulent collection, is in strict accord with what is known of the pathology of acute parotitis. Within twenty-four or forty-eight hours the parotid

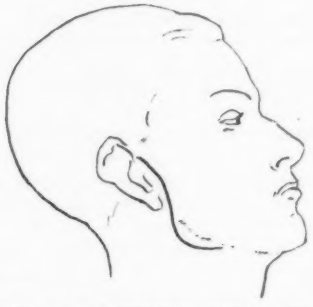


FIG. 4. — Lilienthal's incision for the exposure of the parotid in acute parotitis.

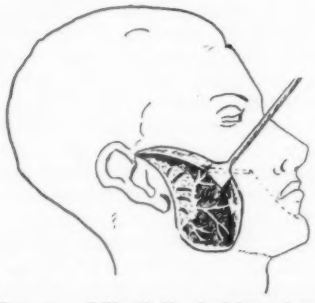


FIG. 5. — Lilienthal's incision showing direction of incisions in parotid gland.

incisions are all freely discharging pus. In an uncomplicated case, healing takes place in from three to four weeks, and what was originally a wide gaping wound on the lateral aspect of the face ultimately becomes an almost imperceptible scar in front of the ear and behind and below the angle of the jaw. At the same time as the external operation is carried out, it may be considered wise to slit the orifice of the parotid duct in those cases where there is an absence of discharge into the mouth. On the other hand, I do not believe that this minor operation alone is ever likely to be of any real value in the treatment of acute parotitis.

In the present series of 54 cases, operative treatment was carried out in 30.

Prognosis.—In the present series of 54 cases of acute parotitis, 11 were fatal, giving a mortality of 20·4%.

In the fatal cases, five were associated with a pyæmia or septicæmia, two followed hæmorrhages from peptic ulceration, one followed an operation for the closure of a fæcal fistula, one followed gastro-enterostomy for carcinoma of the stomach, one was associated with diabetes, hepatitis, and infection of the urinary tract, and one case was associated with aleukæmic leukæmia.

(*B*) *Recurrent Parotitis*

Recurrent pyogenic infections of the parotid form a clinical entity almost as well defined as the acute infections. The disease is much commoner in women than in men. It may affect one or both parotids, and occasionally the submaxillary glands are also involved. The condition is characterized by recurrent swelling of the glands

associated with discomfort or pain, rarely with external inflammatory signs, and not passing on to suppuration. The individual attacks develop gradually or suddenly and are not usually related to eating. Their duration varies from a few hours to weeks or even months, and the frequency of the attacks shows wide variations. Resolution of the attack is in some cases accompanied by the passage into the mouth of tenacious mucopus. The majority of the patients are entirely free from symptoms between attacks; others have persisting mild discomfort, and a few have severe pain in the parotid region.

At times patients date the onset of the disease from a dental infection, from the use of new dentures, or from some infection of the upper respiratory tract. Occasionally, the condition develops as a remote complication of an acute parotitis. The disease is one mainly affecting the female sex, and a striking feature of many of the cases has been the degree of instability.

In the present series there were 52 cases of recurrent parotitis as follows :—

Males 15; females 37. Right 17; left 16; bilateral 19.

The saliva.—The parotid saliva from these cases shows characteristic changes which, although altering in degree during the periods of activity and of quiescence,

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FIG. 6.—The cells found in a catheter specimen of saliva during the quiescent stage.

are always present. The saliva is faintly turbid from the presence of small flakes of mucopus, and microscopic examination shows the presence of epithelial cells and pus cells, the former being either large polyhedral cells or elongated columnar cells. During the more acute phase of the disease pus cells are more likely to be present (fig. 6).

Mucus, although normally almost absent from parotid secretion, is present in considerable excess in the saliva of these patients. The ptyalin content may in some instances be markedly reduced, but this is not of much clinical or practical significance.

Bacteriology.—The *Streptococcus viridans* is the organism most frequently found

in the saliva. In the present series of cases, bacteriological examination was carried out in 30, and the following organisms were found :—

Streptococcus viridans	9
Streptococcus viridans and *Staphylococcus aureus*	2
Streptococcus viridans and pneumococci ...	1
Pneumococci	5
Pfeiffer's bacillus	2
Staphylococcus aureus	1
Gram-negative bacillus	1
Contaminated	1
Sterile	8
Total	30

Sialography.—Investigation of the ducts of the parotid in these cases by means of lipiodol shows varying degrees of abnormality. The most frequent type is that in which the finest ducts show terminal globular dilatations. Lesions are also

FIG. 8.—Bilateral recurrent parotitis. The patient was a man aged 32, with a seven years' history of parotid swellings. The saliva from both parotid glands was turbid and gave a pure growth of *Streptococcus viridans*.

met with in which the larger ducts, or even the main duct, show a dilatation of definitely segmental or fusiform type. In a few cases, particularly those in which an antecedent acute parotitis has occurred, changes of a destructive type may be met with (figs. 7 to 17).

Ætiology.—Some aspects of the ætiology of the condition have already been discussed. Once, however, the infected condition of the ducts is established, it is not difficult to explain its persistence and the recurrent exacerbations. An explanation

PLATE I.

FIG. 7.—Normal parotid sialogram.

FIG. 9.—Recurrent parotitis. Right sialogram from same case as fig. 8.

FIG. 10.—Left sialogram from same case.

PLATE II.

FIG. 11.—Recurrent parotitis. From a woman aged 45 who developed parotitis following influenza twelve years ago. The condition, after persisting for some time, gradually cleared up. She came under observation twelve years later with a further attack of parotitis. The saliva was extremely profuse and turbid and bacteriologically gave a profuse growth of Pfeiffer's bacillus.

FIG. 12.—Left parotid sialogram in a case of recurrent infection of all salivary glands. From a woman aged 56 who developed recurrent submaxillary swellings after scarlet fever at the age of 7. Six years ago, one submaxillary gland was removed. Two years ago, patient began to have recurrent parotid swellings.

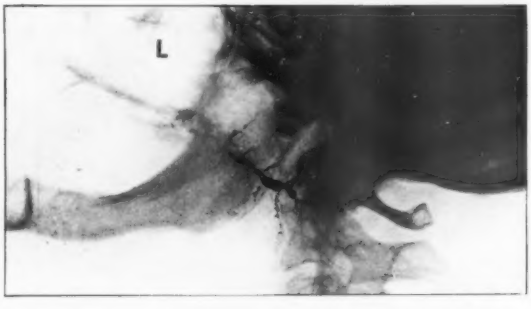

FIG. 13.—Recurrent parotitis. Left parotid sialogram showing segmental type of dilatation. From a woman aged 43 who had suffered from recurrent attacks of parotid swelling for five weeks. The saliva contained a large amount of mucopus, but was sterile on culture.

REGINALD T. PAYNE: Infection of the Salivary Glands.

PLATE III.

FIG. 14.—Right submaxillary sialogram from same case as fig. 13.

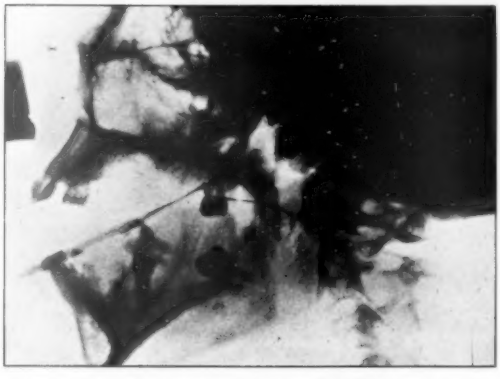

FIG. 15.—Left parotid sialogram in chronic parotitis. Showing destructive type of lesion. From a woman aged 35 who had suffered from bilateral suppurative parotitis and acute suppurative inflammation of both submaxillary glands.

FIG. 16.—Left parotid sialogram in recurrent parotitis. From a woman aged 35 who for eighteen years had suffered from purpura and Plummer-Vinson syndrome. During the past five years there had been five left parotid abscesses, all of which had been drained externally. Between the attacks, there was a constant discharge of pus into the mouth. Cultures of this showed a pure growth of *Streptococcus viridans*.

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of the primary development of the infection is much more elusive. Suggestive evidence has been put forward by Pearson [7] and by others that the condition in children is closely related to the group of allergic diseases including asthma, hay fever, and eczema. This view is supported by the rapidity of onset and offset of the parotid swelling in many of the cases occurring in early life, by the association with known

FIG. 17.—Pneumococcal parotitis. The patient, a woman aged 44, had suffered for eighteen months from recurrent swellings of both parotid glands. When she came under observation the left parotid gland was grossly enlarged. The saliva consisted of thick yellow mucopus, which on culture gave a pure growth of pneumococci. As conservative treatment failed to relieve the condition, external drainage was carried out and the gland was found to contain two large cavities. The wound discharged freely, but healed readily. The photograph shows the scar two months after operation.

allergic phenomena, such as eczema, asthma, or hay fever, by the presence of eosinophil cells in the parotid secretion, and by the improvement in some cases in response to dietetic restrictions. Whether or not the origin of the disease be allergic, it is certain that sooner or later infection occurs and the characteristic obstructive changes in the parotid ducts develop. In the present series of 52 cases, possible ætiological factors were present in 14. The details of these are set out in the following table :—

Dentures	1
Dental infection	2
Frequent sore throats	1
Following tonsillectomy	1
Enlarged tonsils	1
Trauma to cheek	1
Post-acute parotitis	1
? post mumps	1
Chill following driving	1
Congestion of lungs	1
Purpura, Plummer-Vinson, and splenomegaly	1
Eczema as child (mother, hay fever) ...	1
Subject to hay fever and skin eruptions ...	1
Total	14

Histology.—In only one case in the present series was any histological examination of the parotid possible. This showed marked proliferative change of the cells in the interior of the smaller ducts, together with dilatation of the duct and surrounding round-celled infiltration (fig. 18).

Differential diagnosis.—Many of the patients suffering from recurrent parotitis are regarded as cases of mumps or recurrent mumps, though it is almost certain that second attacks of that infection do not occur. Cases are also confused with parotid enlargements associated with stone, with Mikulicz's disease, uveoparotitic polyneuritis, innocent and malignant parotid tumours, and pre-auricular lymphadenitis.

Treatment.—Treatment must be considered both during the periods of quiescence and during actual exacerbations of the disease. During the quiescent periods, many of the milder cases can be kept free from attacks by massage of the parotid. Where

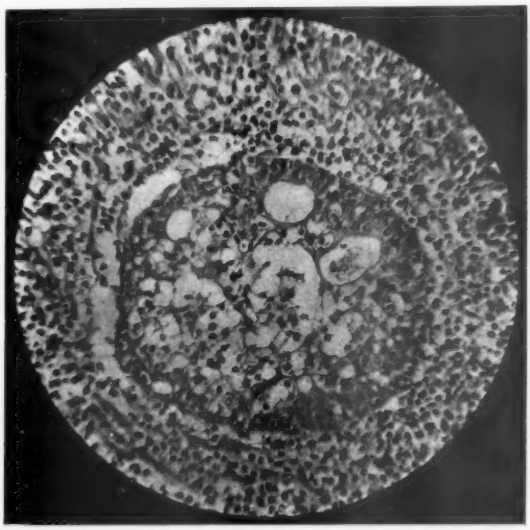

FIG. 18.—Recurrent parotitis. Section of parotid showing recurent parotitis. There is marked proliferation of the duct epithelium and surrounding round-celled infiltration.

there is any evidence of obstruction involving the main duct, operation may be of value. This involves the excision of the distal half-inch of the duct and the incision of the medial wall of the duct behind this, as far back as possible. The resulting cavity is packed, and a week later the orifice is dilated under anæsthesia. This is followed by repeated dilatation until healing is complete. In one severe bilateral case in the series, auriculo-temporal avulsion was carried out with marked temporary benefit, though ultimately the nerve regenerated on both sides. Some cases may be strikingly benefited by the use of X-rays, and not only may symptoms disappear, but a considerable swelling of the parotid may resolve without any evidence of functional disturbance of the gland.

(*C*) *Chronic Parotitis*

Chronic pyogenic infection of the parotid is not nearly so frequent as either acute infection or recurrent infection. In the present series of 117 cases of parotitis, only

11 could be regarded as strictly chronic in type. In eight of these, there was some associated local or general condition. In five cases, parotid calculi were present (one of these was a doubtful case), and one case followed acute parotitis. The seventh case was associated with rheumatoid arthritis and the eighth showed extensive diffuse calcification of both parotids, and was associated with scleroderma and Raynaud's phenomena (figs. 19 to 21).

Infection of the Submaxillary Gland

There are certain fundamental differences between the pyogenic infections occurring in the submaxillary gland and those in the parotid. Primary acute infection of the submaxillary gland is rare, and most acute infections are secondary to calculi within the duct or the gland itself. At the same time, primary chronic infection also occurs in a small group of cases, but recurrent infections comparable with those in the parotid are unusual. I do not propose to enter into the debated subject of the cause of salivary calculi. Whether or not these are primarily infectious in origin is still disputed, but it is certain that sooner or later they are associated with infection of a chronic nature which may under certain conditions become acute and lead to serious complications.

(A) *Calculus cases :—*			
Uncomplicated ...	...	...	56
With acute infection	...	...	18
			74
(B) *Non-calculus cases :—*			
Chronic infection	...	...	7
Recurrent infection	...	...	2
Acute infection with acute glossitis			1
With duct obstruction	...	...	6
With hypertrophy	...	...	1
			17
		Total	91

The long course of the submaxillary duct, its important anatomical relations in the floor of the mouth, the anatomical features of the sublingual and submaxillary regions, and the laxity of the adjacent cellular tissue, together with the frequency of calculi in the duct, make inflammatory changes in its walls and surroundings of much greater importance than inflammatory changes in the parotid duct. In the case of the submaxillary, the brunt of the acute infection falls upon the duct and its surroundings, with but relatively minor changes in the gland itself, whilst in the case of the parotid it is the glandular tissue which is mainly affected, the involvement of the duct being of but secondary importance.

Acute infection and the clinico-pathological types.—Acute infection of the submaxillary gland and duct is, in practically all cases, an ascending infection from the buccal cavity, and the majority of cases are associated with the presence of calculi in the duct or gland. A smaller group of cases is traumatic in origin or due to the entry of foreign bodies into the duct. Others again are secondary to malignant growths in the floor of the mouth, or to strictures of the duct, or they develop as part of a very diffuse inflammation of the floor of the mouth, the tongue, and the cellular tissue of the submaxillary region.

From the pathological point of view, an outstanding characteristic of acute infections of this region is the fact that they so often tend to be of the nature of a cellulitis,

associated with an extreme degree of œdema and congestion, which may involve the floor of the mouth, the tongue, and the submaxillary region, and even spread to the glottis. Submaxillary calculi are in themselves comparatively trivial, yet the acute complications to which they may give rise may be extremely dangerous ones. Some of these cases pass almost insensibly into the group known as Ludwig's angina. This was defined by von Ludwig in 1836 as an inflammation of the cellular tissues starting around the submaxillary gland and subsequently involving the neck and the floor of the mouth.

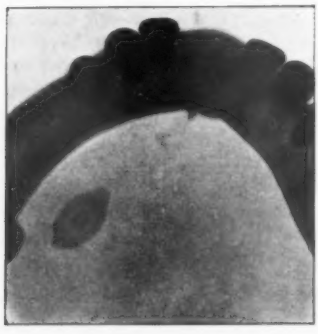

FIG. 22*a*.

FIG. 22*b*.

FIG. 22*c*.

FIG. 22.—Submaxillary duct calculus. (*a*) Skiagram showing calculus in situ. (*b*) Skiagram of calculus after removal, showing nucleus. (*c*) Photograph of calculus after removal.

Amongst the 74 cases of calculi in the submaxillary gland or duct in the present series, there were complications due to acute infection in 18 cases. This acute infection was the result of impaction of a calculus at some part of the duct. In 10 cases, the infection was limited to the duct and its immediate vicinity. In five cases, the inflammatory changes were extensive and were associated with difficulty in swallowing and breathing. In the remaining three cases, the condition was complicated by a suppurative lymphadenitis. Many of the patients in this group were extremely ill when they came under observation (figs. 22 to 24).

The acute inflammatory complications may thus be confined to the duct and gland, or may involve the cellular tissue of the sublingual or submaxillary regions, or spread to the tongue. Suppurative changes may occur in connexion with the submaxillary or other lymph-glands and abscesses may at times track considerable distances down the neck. In cases where the condition is due to duct calculi, resolution may take place either as the result of the passage of the calculus through the duct orifice or its perforation through the duct wall.

Diagnosis.—In acute parotitis, the outstanding feature in diagnosis is the determination of the systemic background to the disease. In acute infection of the

PLATE IV.

FIG 19.—Chronic parotitis with monilia infection of buccal cavity. Right sialogram showing gross dilatation of main duct.

FIG. 20.—Chronic parotitis showing left parotid calculus.

FIG. 21.—Chronic parotitis showing calcification of parotids. From a woman aged 30 with Raynaud's phenomena and scleroderma.

PLATE V.

FIG. 23.—Large calculus in posterior third of submaxillary duct.

FIG. 25.—Normal left submaxillary sialogram, showing communication with duct of sublingual gland.

FIG. 26.—Lipiodol injection of normal submaxillary gland.

submaxillary gland, it is the local background which is important. In arriving at an exact diagnosis, the history, the physical signs, and the presence of any associated buccal disease will be of outstanding importance. It is impossible to discuss here all the aspects of differential diagnosis, but it is certain that many of these cases are confused with other conditions.

Treatment.—The treatment of the acute infections of the submaxillary gland and duct depends upon the local causative factor bringing about the acute complication, the stage at which the case comes under observation, and its main pathological features. The inherent risks of acute infection in this region cannot be too strongly stressed, for the safety factor is at times a low one.

FIG. 24.—Suppurative cervical adenitis, secondary to infection of submaxillary gland.

In cases in which the condition is due to impacted calculus in the duct, the calculus should of course be excised. When this is of such a small size that its removal would be difficult in the presence of the acute inflammatory œdema and congestion in the floor of the mouth, then the duct should be incised behind the calculus. The drainage provided in these ways usually leads to the rapid resolution of the infection.

In cases in which a submaxillary abscess develops secondarily to a calculus within the gland or posterior part of the duct, or in which a suppurative submaxillary lymphadenitis occurs, the region will have to be drained. Subsequently, of course, if calculi are present the gland must be removed. Some of the cases of this type, after an acute course, subside to some extent, and then pass into a subacute phase which may last for many weeks. It is difficult in many of these cases to determine the exact state of affairs. In some of them there is a subacute infection of the submaxillary gland associated with calculi, and the whole gland is enlarged and matted to its surroundings. In other cases again, a small associated abscess is present in the immediate vicinity. It is probably best in these cases to excise the submaxillary gland and to drain the wound, but the operation can be a difficult and tedious one. The acute, diffuse infections of the floor of the mouth and the submaxillary region present a much more

serious problem in connexion with treatment. It is important in these cases to drain not only the sublingual region, but also the submaxillary region. External drainage is necessary in all cases, and this will necessitate a division of the mylohyoid muscle or the removal of the submaxillary gland. Each of these procedures has its advocates. At the same time, it may be necessary to incise the floor of the mouth and the tongue.

Recurrent infection.—Recurrent infection of the submaxillary gland is rare in the absence of calculi or of a stricture of the duct. There is a small group of cases, however, in which the condition is strictly comparable to the recurrent infection occurring in the parotid gland, and in which calculi and duct strictures can be excluded. This condition may at times begin in one submaxillary gland and then spread to the other, and may ultimately involve the parotid glands. In other cases again, the condition starts in the parotid and later involves the submaxillary glands.

Chronic infection.—Chronic infection of the submaxillary gland or duct is much commoner than acute infection and, as has been pointed out, it is usually the clinical background to acute infection. Primary chronic infection occurred in seven cases in the present series of 91. It is impossible to be dogmatic about these cases, for in some of them a minute calculus may have been overlooked. Secondary chronic infection is commonly due to calculi—and, less commonly, to duct obstruction, malignant disease of the floor of the mouth, foreign bodies, or dentures, &c. (figs. 25 and 26).

Pathologically, in these cases, the submaxillary gland shows the characteristic changes of replacement fibrosis. At times, the gland is a little larger than normal, but at other times the chronic inflammatory changes may have produced a gland three or four times the normal size.

On the clinical side there is little to distinguish the primary and the secondary groups of cases. In the primary group the symptoms are more likely to be steadily progressive, whilst the secondary cases, due to calculi, are likely to be more typical of recurrent duct obstruction. As the functional activity of the gland is impaired, its tendency to swell with meals diminishes.

The causal factor in these cases must be determined when possible. In the absence of any gross local cause, the submaxillary gland should be excised. A calculus in the anterior two-thirds of the duct should be excised through the floor of the mouth. When calculi are present in the gland itself, or when they are of a recurrent nature, the gland should, of course, be excised.

Infection of the Sublingual Gland

All types of infection of the sublingual glands are rare. Acute suppurative infection has been described as a primary condition or in association with the very rare calculi which occur in the sublingual gland or ducts. On the other hand, involvement of the sublingual gland secondary to other acute inflammatory processes of the floor of the mouth and tongue is much commoner. In such cases, the infection is really interstitial rather than parenchymatous. The commonest ætiological factor in this connexion is of course acute infection of the submaxillary duct associated with calculus obstruction.

The sublingual gland may be involved in the diffuse phlegmonous inflammation of the floor of the mouth coming under the general heading of Ludwig's angina. The important anatomical connexions of the sublingual and submaxillary regions have already been described.

The sublingual salivary gland may also be involved in a secondary chronic inflammatory process as the result of changes in the immediate vicinity. This chronic sublingualitis may be secondary to submaxillary duct calculi, to operations, or to growths in the floor of the mouth. In such cases, also, the process is interstitial.

The inflammatory conditions affecting the sublingual gland are thus relatively unimportant when considered in terms of this organ as a salivary gland. Such

importance as these infections have arises almost entirely as the result of local anatomical factors.

Conclusion

It has been possible in the course of this paper to consider only certain aspects of pyogenic infections of the salivary glands, and I am fully conscious of many omissions. In concluding, there is one omission to which I would like to refer. I have in this paper confined myself strictly to infectious conditions, but it is certain that just as the secretion of saliva is determined largely by psychological stimuli, in many of the patients with infections of these glands there is an associated or even superimposed functional element. This is, of course, only likely to be the case in recurrent or chronic infections, but I am satisfied that this element exists, that it produces very real symptoms, and that it may confuse the clinical picture.

In connexion with acute infections of the parotid, I would like to stress their pathological features and the necessity for basing rational treatment on these. At the same time, when confronted with a case of acute parotitis we must always ask the question, " Why has this patient acute parotitis, and what is the general clinical background of the process ? " The recurrent infections of the parotid are of much greater clinical frequency than parotid calculi, and although their pathology has been elucidated, they often escape recognition, and as yet therapeutic measures for their control are not entirely certain.

In connexion with infections of the submaxillary glands, I would like to stress the serious nature of the acute complications of the relatively frequent submaxillary calculus, and, in connexion with the acute infections as a whole, the importance in all cases of the anatomical features of the region and the necessity for determining the local pathological factors leading to acute infection.

The successful treatment of many buccal conditions demands co-operation between the dental surgeon and the surgeon interested in the more general aspects of buccal diseases.

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JOINT DISCUSSION No. 2

Section of Laryngology and Section of Medicine

Chairman—C. A. SCOTT RIDOUT, M.S. (President of the Section of Laryngology)

[*December* 3, 1937]

DISCUSSION ON THE VALUE OF BRONCHOSCOPY IN DIAGNOSIS AND TREATMENT

V. E. Negus: When I was asked to speak in this discussion it appeared to me necessary to review all the cases of which I had satisfactory records. I have done so and have traced most of the patients with whom I have dealt since the commencement of my endoscopic work in 1924.

The first and obvious value of bronchoscopy is the removal of foreign bodies, but it would be useless to expect success if endoscopic practice were confined to this type of case. Of my first 100 bronchoscopies only five were foreign-body cases, while 95 were for the examination and treatment of lung suppuration and neoplastic diseases. For various reasons the proportion has altered; of a total of 173 patients 49 were referred on account of actual or supposed foreign bodies in the bronchi; and of 570 bronchoscopic examinations 97 were for the detection or removal of these objects, while the remaining 473 gave practice to make this type of work more easy.

The laryngologist has another source of instruction, in the œsophagus. I have records of 160 cases of carcinoma examined or treated, and of many others with various non-malignant complaints.

The conclusion is that all types of peroral endoscopic work have a value as regards the removal of foreign bodies. Of 49 foreign-body cases, 44 had a complete cure. Six objects were coughed up, four after bronchoscopic examination and two during their journey to hospital; this is a proportion too low to allow of delay in bronchoscopic examination, in the expectation of spontaneous cure. Of five unsatisfactory cases peculiar circumstances prevented the attainment of a perfect result. Two required lobectomy because of failure to remove the foreign body in a lung disorganized by suppuration; in such cases there should be no hesitation in referring the patient to a thoracic surgeon, but much may be done to improve the local and general conditions by preliminary bronchoscopic treatment.

The next, and more extensive, field of bronchoscopy is connected with lung suppuration, when foreign bodies are not the cause of the disease. Of these I have notes of 67 patients, for whom 372 bronchoscopic examinations or treatments were required. Cases of lung abscess show the largest proportion of successes; of 35 cases, 13 were cured and another 13 materially improved. Twelve patients required some form or other of external operation.

Most abscesses commence within a bronchus, as a result of partial or complete blockage by a foreign body, a lump of coagulated pus or infected blood-clot, or a plug of viscid mucus, as occurs in massive collapse.

The walls of the bronchus are swollen, granulations appear, and the ciliary stream is impeded. Infection is set up in the air passages beyond the point of obstruction and secretions collect, at first mucoid and later purulent. As the bronchi then contain pus the condition may well be called one of bronchial abscess ; it is remarkably amenable to bronchoscopic treatment and, in my opinion, it is wrong to neglect this probable means of cure. Even when this intrabronchial condition is followed by breaking-down of the walls, with the production of a parenchymatous or true lung abscess, cure may still, on occasion, be obtained without external operation. The same observation applies to primary parenchymatous abscesses which have ruptured into a bronchus.

It is the well-established abscess with thick walls and an absence of ciliated epithelium in its lining, that calls for external drainage or lobectomy ; even then preliminary bronchoscopic aspiration will make conditions safer for operation. Without a direct examination and a trial of bronchoscopic treatment, it is impossible to say which cases will respond. It is also impossible to determine whether a foreign body is present ; the object may be radiologically invisible in opaque, collapsed and sodden lung tissue. If a foreign body is found and removed, cure of the suppuration may be expected, even after a sojourn of years, as illustrated by 16 such cases with 14 successes.

Bronchiectasis, whether unilateral or bilateral, responds much less well to bronchoscopy, and cure cannot be looked for. Improvement, however, may be attained, as in 15 out of 23 cases treated by myself. Some patients with bronchiectasis, for whom lobectomy is not indicated, are enabled to live useful and comfortable lives by regular courses of bronchoscopic treatment.

A number of cases of neoplastic disease are referred for bronchoscopic examination or treatment and much may be done for these patients. Not only can a reliable diagnosis be established in cases of doubt, but useful treatment can be carried out. Amongst the patients examined a small proportion will be found with neoplasms of a type capable of cure. I have only two amongst 51 patients, but the successful result in these justifies the other examinations ; it is only by direct inspection that the favourable cases can be discovered. One patient had a simple fibroma ; she was well for six years, but then suffered from a fresh neoplasm of different type. The other had an adenocarcinoma, invading the muscle of the bronchial wall, and in his case cure seems to be permanent.

Squamous-celled carcinomata are amenable to palliative treatment. The symptoms they produce are due not so much to the presence of growth in the lung as to mechanical obstruction of the bronchi. Removal of this obstruction re-establishes ventilation and drainage of the lung in parts beyond the growth. The best results are obtained in carcinomata affecting the upper lobe. Clearance of the lumen may be attained by removal of masses of growth with biting forceps, by the insertion of radon seeds directly into the neoplasm, or by the introduction of a container loaded with seeds. The latter can be left in place for a week and, if of suitable design, it should not be coughed out. There are certain cases with collapse in portions of the lung where the diagnosis lies between obstruction by an intrabronchial growth, a mediastinal neoplasm, or an aneurysm.

Bronchoscopic examination allows a correct opinion to be given. I have records of 17 such cases, with pressure on the bronchial walls. The question is one of importance, as similar signs and symptoms may be due to intrabronchial obstruction, amenable to treatment.

There remains the question of unexplained haemoptysis. Bronchoscopy is often required to establish a diagnosis ; in many cases new growth may be found, and in others granulations caused by localized suppuration. There are, in addition, a few in which no gross changes are found and, possibly, no more is seen than a small rough patch, from which bleeding occurs, similar to the area in the septum of the nose in cases of epistaxis.

L. S. T. Burrell said that to the physician bronchoscopy was an extension of the examination of the larynx by laryngoscopy. In a case of hæmoptysis of unknown origin it was a matter of great importance to have a bronchoscopic examination. Students should still be taught to regard hæmoptysis of unknown origin as tuberculous, but there were other causes. He did not think that frank hæmoptysis was ever due to a bleeding spot in the throat, but it might be due to a fibroma in the bronchus. Mr. Negus had referred this evening to a case which he (the speaker) had seen some years ago. The patient was a young woman who had hæmoptysis; she was in a sanatorium for fourteen months, but no evidence of tuberculosis could be found. After the fourteen months in a sanatorium, lipiodol was put into the trachea and X-ray examination showed a blocked bronchus. Mr. Negus, on bronchoscopic examination, discovered a fibro-adenoma which was the cause of the hæmorrhage, He removed it, but several years after the operation carcinoma of the bronchus developed and the patient died. Even the polypoid and apparently innocent growth might contain some malignant cells. These cases of growth—fibroma or adenoma—were rare, and when they were met with it was important that they should be recorded.

Carcinoma of the bronchus usually showed itself first either by a slight hæmoptysis, or a blocking of a bronchus and consequent collapse of the lung. In these cases lipiodol would show the blocked bronchus, and that was strongly suggestive of carcinoma, but bronchoscopy would clinch the diagnosis. Often the condition had gone too far for operation by the time the physician saw the patient. Eighteen months ago a patient who had had indigestion for many years was sent to hospital for X-ray examination of the gastro-intestinal tract. One film happened to include the lower part of the thorax and revealed a carcinoma of the right lung. Mr. Tudor Edwards removed the lobe, and the patient made a very good recovery.

He had been much impressed by the great increase in the scope of the thoracic surgeon, in successfully removing not only the lobe, but, if necessary, the whole lung. Bronchoscopic examination might enable the surgeon to decide whether or not the growth was operable.

Mr. Negus had referred to abscess of the lung, and also to what he called bronchial abscess, in which there was a pent-up collection of pus. Bronchoscopy was not of very great value in the diagnosis of abscess, because the diagnosis was usually fairly simple otherwise, but it was of value in distinguishing between a simple abscess and one which was the result of the breaking-down of carcinoma. He had seen one or two cases of the latter made very much worse by operation. Treatment of abscess by aspiration through a bronchoscope sometimes led to a cure and saved the patient the risk of operation.

Nor was the bronchoscope of great value in the diagnosis of bronchiectasis, which was now diagnosed largely by X-rays and lipiodol or other opaque substance; but bronchoscopy might reveal the presence of a foreign body as the cause. For treatment, bronchoscopic aspiration was valuable for many of these cases, and the fact that some patients returned again and again for aspiration whenever they felt the need of it showed that the relief given was sufficient to make them undergo the discomforts of the procedure.

He had seen one or two patients desperately ill who, on postural drainage, had been unable to cough up the bronchiectatic abscess. After bronchoscopy some pus had come out of the bronchial tubes and cleared them, so that the patient could carry on with the postural drainage.

G. Ewart Martin: It is a debatable subject as to whether endoscopy should remain in the hands of the laryngologist or become a specialty on its own account. An endoscopic examination should never be performed without a previous complete

examination of the pharynx, hypopharynx, and larynx. Bronchoscopy is inaccurate without a training in monocular vision.

In America bronchoscopy has become a specialty in itself, and therefore more endoscopic examinations are carried out there, and the removal of foreign bodies from the chest is more widely reported. In this country it seems that either insufficient use of the bronchoscope is made in diagnosis and treatment, or we are falling behind the standard set up during the first few years of the specialty.

Team work is essential; the physicians and radiologists are the senior partners to the endoscopist, and in treatment the thoracic surgeon must also take his share in the partnership.

The Uses of the Bronchoscope

Foreign bodies in the air passages.—Only by bronchoscopy can foreign bodies in the bronchus be removed. Diagnosis may be easy, as in two very similar cases which came under my care. Both children had inhaled a squeaker from a whistle, and each discovered that he could amuse his travelling companions on the journey to Edinburgh by squeaking on forced expiration.

The possibility of the presence of a foreign body as a cause of many chest symptoms is too often forgotten. I have never been able to explain why so many more foreign bodies are removed (from the chest) in the bronchoscopic clinics in Philadelphia than in all our clinics in this country. The only explanation seems to be that in this country the inhaled foreign bodies are coughed up or partly forgotten.

The diagnosis of a foreign body may be difficult. This may be illustrated by a case which I have previously reported, in which I removed a mutton bone, half an inch by one inch, from the right bronchus of a patient whose only complaint was intermittent cough and whose chest was reported clinically and radiologically clear.

Bronchoscopy is essential in the diagnosis of many lung lesions, as is demonstrated by the following cases :—

I.—*With Hæmoptysis as a Symptom.*

This case is of interest not only to the physician but also to the medico-legal expert.

H. N., aged 54. History of a motor accident two years before when he had a dislocation of the hip and a fracture of two or three ribs on the left side and hæmoptysis. He was in bed for about two months; when he began to go about again he had frequent attacks of hæmoptysis. On two or three occasions he was readmitted into hospital but nothing was found in the chest, which remained clear both clinically and radiographically. The patient was examined on various occasions by medical referees, with regard to compensation, and this was continued on account of the hæmoptysis. He was referred for bronchoscopic examination and this was carried out under avertin. A minute polypus was discovered at the mouth of the middle lobe bronchus on the right side. This was removed for pathological report and was found to be a definite spheroidal-celled carcinoma.

II.—*With Cough and Hæmoptysis as Symptoms.*

Mrs. R., aged 49. History of attacks of hæmoptysis for many years. The chest was clear both clinically and radiologically and it was thought that this was a case of early pulmonary tuberculosis. The patient was sent abroad for one year. The chest was found to be clear but the hæmoptysis continued. Bronchoscopy revealed a small nævus at the carina extending down the medial wall of the right bronchus. Although this could have been eradicated by diathermy it was thought best to leave it alone on account of its position and for fear of after-contraction which might narrow the bronchus. The attacks of hæmoptysis are now at wider intervals.

III and IV.—*Two Cases having Cough as the Only Symptom.*

History of a cough for many years—coming on in spasms—very little sputum and occasional hoarseness. Clinical and radiological examination of the chest was negative. Both patients had marked paroxysmal attacks of coughing leaving them almost prostrate. Bronchoscopic examination showed, in both cases, that the whole of the middle line of the

bronchus embodying the musculo-trachealis was raised on coughing in a collar-stud formation passing forward on to the anterior wall of the trachea, keeping up a spasm of coughing. It is interesting to note that in one of these cases Sir John Fraser performed cervico-dorsal ganglionectomy and that there has been no return of the symptoms.

V.—*With Hæmoptysis and Cough as Symptoms; Radiologist's Report Leading to a Wrong Diagnosis.*

Patient first seen six years ago. The radiologist reported a carcinoma of the upper lobe bronchus with an occlusion of the bronchus. Patient had a cough for some time and was spitting up blood. Clinically the chest showed a dullness over the right middle lobe. Bronchoscopy did not confirm these reports, but instead revealed a large abscess connected with an aberrant small bronchus opening into the right eparterial bronchus. This abscess was aspirated and was found to have chronic thickened walls. The patient has had further bronchoscopic drainage at intervals during the last six years.

Treatment with a bronchoscope is only a further advancement in diagnosis. It is the best method of treating many forms of lung abscesses.

Bronchiectasis.—Since 1922 I have been carrying out the method of bronchoscopic drainage referred to in previous reports, using in many cases the introduction of a boric solution, or normal saline solution, as a means of dilution if the pus is too thick to be evacuated by normal suction. In these cases bronchoscopy is the ideal treatment—allowing free drainage of the lower part of the lung so that daily postural coughing may be carried out. In some cases it is necessary to dilate, or even over-dilate, the narrowing above the various cavities in the bronchi. I have been able to report a number of complete cures out of about 200 cases. In almost every case of bronchoscopic drainage the patient has been benefited. Some patients return voluntarily and ask to be bronchoscoped again whenever they notice that there is a damming-up of secretion shown by the return of the bad odour to their breath. A few, after one examination, have been considered unfit for further treatment.

In modern chest surgery the operations of lobectomy and thoracoplasty have become much easier to perform, but there is no doubt that in many cases of lung abscess in which the chest has been opened radically the abscess would have been cleared up by bronchoscopic drainage. In cases of bronchiectasis, removal of the infected lobe would effect a certain cure, but in the majority of cases, unfortunately, the disease is not limited to one lobe but extends to three—the middle and lower lobe right, and the lower lobe left. In these cases the removal of one lobe would not effect a cure, nor would the removal of the whole lung. Pneumothorax in these cases has also failed. Phrenic evulsion has proved successful in a few cases, but only where the lower lobes have been affected.

The bronchoscopist should be the final judge as to whether the patient's chest is in a fit condition to warrant an external operation.

Bronchoscopic treatment of tumours of the lung.—The simple tumour of the bronchus, with its accompanying symptoms of cough and occasional hæmoptysis, calls for bronchoscopic treatment. Many cases have been published at various centres on this subject.

In lobar pneumonia and in bronchopneumonia recovery by absorption is usually expected. For some unknown reason in a few cases recovery takes place slowly by organization, and this may go on to the formation of pus—that is, to a lung abscess. If, however, this slow organization is recognized early and bronchoscopic examination is carried out, the establishment of drainage, the permission of better aeration, or the removal of pus, will allow of a rapid recovery and will prevent the disease from becoming chronic or a bronchiectasis being established.

Thus closer co-operation between the physician and the bronchoscopist is necessary but unfortunately the general practitioner has yet to learn that in the use of the bronchoscope we have a diagnostic and therapeutic means which cannot be disregarded in the treatment of chronic non-tuberculous diseases of the chest.

H. V. Morlock : From experience of some 4,500 bronchoscopies, in 1,100 patients, I hope to be able to show the actual value in these cases. These 1,100 patients have fallen into three large groups, namely those with (1) pulmonary suppuration ; (2) new growths, innocent and malignant ; (3) unexplained hæmoptysis ; and also into smaller groups, such as those having collapsed lobes, tuberculous patients, and asthmatics.

Dealing first with pulmonary suppuration, I will discuss bronchiectasis now, and abscesses later.

Even if there is a diversity of opinion about the value of treatment of bronchiectasis by bronchoscopic lavage, there can be no doubt that every case of bronchiectasis should undergo a diagnostic bronchoscopy. The reason for this is that in a number of cases the bronchiectasis is secondary to some intrabronchial disease, which can only be diagnosed by bronchoscopic vision, and to treat the secondary bronchiectasis, without first considering the ætiological factor, is irrational.

We have carried out this diagnostic bronchoscopy in 240 cases of bronchiectasis, and have found six malignant new growths ; six innocent new growths ; one foreign body ; one lung stone, eroding the bronchus and causing obstruction ; four fibrotic stenoses, of unknown ætiology ; two left middle lobes, which were the site of the bronchiectasis, a point of importance if lobectomy was being considered. Thus, in 8·5% of the cases, the diagnostic bronchoscopy has yielded a result of importance.

There is only one radical treatment of bronchiectasis, and no other treatment at present known will cure the patient, but many patients are unwilling to take the risk involved in the operation of lobectomy. A smaller number are unsuitable subjects for lobectomy, because of the bilateral nature of their disease.

We have treated 115 patients by postural drainage and bronchoscopic lavage. Unless they were suffering from bilateral bronchiectasis, they were all advised to consider submitting themselves for lobectomy before we undertook bronchoscopic treatment.

The procedure we adopt is to carry out a bronchoscopic drainage at weekly intervals, and then as the condition improves, to lengthen the interval between treatments, up to six weeks. Finally the patients decide to come to the clinic when they feel the need of treatment. All show an initial improvement, and the majority have so progressed as to be able to lead a useful life. During the six years under consideration, four patients have died whilst under treatment, four more left off treatment and subsequently died. Of the 107 still receiving treatment and remaining well, not one is cured, and it must be expected that in the course of another six years, some more of them will die from their disease. This fact does not detract from the value of bronchoscopic drainage as a valuable palliative treatment for those patients who are unwilling to submit to lobectomy, or are unsuitable for it.

It has been suggested that these patients would have done just as well on postural drainage alone. The answer to this suggestion is that the majority only come up for treatment when they feel the need for it, and we do not believe that, after having undergone some thirty to seventy bronchoscopies they would, of their own accord, present themselves for further treatment unless they were deriving benefit from it.

Abscesses.—In abscess of the lung, the necessity of a preliminary diagnostic bronchoscopy is even greater than in bronchiectasis, for the following reasons : (1) A causative factor may be found. (2) If a lung abscess is to heal by medical treatment, the bronchus of drainage must be free, and this can only be known by bronchoscopic vision. (3) In the medical treatment of a lung abscess, postural drainage is an important factor, for unless the exact bronchus of drainage is known—and it can only be known by direct vision—a faulty position of drainage may be chosen.

For these reasons, we have carried out a diagnostic bronchoscopy in 163 cases of abscess. We have found eight malignant tumours and one innocent one. In all the cases we have been able to ascertain the position and condition of the bronchus of drainage.

The diversity of opinion on the treatment of lung abscesses is well illustrated by the discussion at the last meeting of the British Medical Association in Belfast, when one speaker, without quoting his experiences, condemned bronchoscopic treatment, another, with the experience of only a few cases, was not without enthusiasm, while the surgeons were advocating earlier operative interference. To those who have had experience of lung abscesses this diversity of opinion is not surprising, for there is no one single therapeutic measure which can be considered to be the method of choice in every case of lung abscess. Each method has its value, and the real problem is to know in which case to employ it.

In order to learn in which cases bronchoscopic treatment would be of value, we decided to use it in all the cases which came to us, and after having dealt with 117 cases, we consider that we are able to suggest which cases will respond to this treatment, and which are best dealt with by other measures. The cases which respond to bronchoscopic treatment are the single abscess cavities. Their position, or their duration, does not appear to influence the results to a great extent, but what is of significance is the amount of inflammation in the surrounding lung tissue. The greater the amount of inflammation, the smaller the chance of success. When this surrounding inflammation is very extensive and intense, a carbuncle-like condition of the lung is produced, in which secondary abscesses and bronchial dilatation appear. This condition is sometimes called bronchiectatic abscess; in such cases bronchoscopic treatment is of little value.

We have treated 98 single abscesses, including our early cases, some of which we would now consider unsuitable for bronchoscopic treatment. Seven patients died during treatment; in three an empyema developed, and these were dealt with surgically; 14 failed to improve; one was improving, but discharged himself; 73 recovered. These results, although not entirely unsatisfactory, leave much to be desired, and now that we know which cases respond to treatment, we should be able to improve upon them.

We have had 18 cases of bronchiectatic abscesses. The first 13 we attempted to treat, and in five of these we succeeded in rendering the patients afebrile, but were unsuccessful in dealing with the residual bronchiectasis. The later cases we have not attempted to treat bronchoscopically, but have called in our surgical colleagues to deal with them.

New growths.—Perhaps the most valuable service which is rendered by bronchoscopy is the help which it gives in the diagnosis of bronchial new growths. Without its aid the diagnosis of this condition is always one of assumption, until a late stage in the disease, when secondary glandular involvement has taken place.

It is true that radiology is helpful in the diagnosis of this condition, particularly after the introduction of lipiodol, when an obstructed bronchus may be demonstrated; more recently this has also been demonstrated by tomography. Nevertheless, the true nature of the obstruction can only be ascertained when it has been seen through the bronchoscope and a piece removed and examined microscopically.

We have examined 191 cases of new growth, and in over 10% of these cases the growth was not suspected before the bronchoscopy, because the presenting symptoms had suggested an abscess or a bronchiectasis, and occasionally because the sputum was positive for the tubercle bacillus. It is not very uncommon for a new growth to light up an old tuberculous focus. In other cases, a pleural effusion or an empyema had masked the physical and radiological evidence of the growth.

In another 5% of cases, the physical and radiological examinations were negative, but the presence of an unexplained cough, stridor, or hæmoptysis, in a male patient over 40 years of age, suggested the possibility of a new growth and the desirability of a bronchoscopic examination. This group is of importance, because if these cases are to be successfully dealt with by lobectomy, they must be diagnosed early, before they have progressed far enough to give physical and radiological evidence of their presence.

Of the 191 new growths, 161 were seen at bronchoscopy, and in the majority a piece was removed for microscopical examination. In five other cases the growth was only seen by means of the retrograde telescope, to be high up in the upper lobe bronchus. In these cases, it was impossible to obtain a piece for examination. In 25 cases the growth was not seen, but the findings were so characteristic that a diagnosis of malignant disease was confidently made, and verified by the subsequent course or post-mortem examination. These characteristic findings are :—

(1) The distortion of the bronchial wall due to pressure from without.
(2) A plaster-of-Paris appearance of the bronchial wall.
(3) A complete loss of the normal characteristic respiratory mobility of the bronchus.

From the point of view of cure the introduction of intrabronchial radon is quite useless ; we have treated some 90 cases without one single success. It is true that a few of the patients have survived for two or three years with this treatment, but probably equally many live so long without any treatment. Intrabronchial radon is useful in helping to keep the bronchial lumen patent and thus avoid asphyxia and pulmonary suppuration behind the growth, which previously made the death of these patients so distressing.

Innocent new growths.—The most interesting and satisfactory group with which we have dealt has been the innocent tumours, because they can only be diagnosed by bronchoscopy, and once diagnosed, they can be successfully treated. We have dealt with 13 such tumours, all of which were unsuspected before they came to us. They are either pedunculated or sessile, of the same colour as the mucous membrane, and often finely nodular on the surface.

As regards their histology as we have pointed out elsewhere, and other authors have done the same, there exists considerable difficulty in establishing their true nature, and they are often confused with malignant conditions. We found seven adenomas, all of these were at first considered to be malignant, but subsequent sections confirmed their benign nature, also one fibro-adenoma, two papilloma, and three polypoid conditions probably of inflammatory origin.

We have been successful in removing all these tumours by intrabronchial diathermy or radon. In our experience, intrabronchial diathermy is superior, because it leaves much less fibrosis than the radon. In two cases the growth has recurred, the recurrence being successfully treated.

Hæmoptysis.—Hæmoptysis without any definite physical or radiological signs, is always a source of considerable worry, both to the patient and the doctor, because both are equally conscious that it may be the first symptom of a serious disease, and any investigation which will help in establishing the diagnosis is well worth while undertaking. We have bronchoscoped 107 such cases, and have found : 14 unsuspected cases of dry hæmorrhagic bronchiectasis ; three innocent new growths ; four malignant new growths ; two lung stones, ulcerating the bronchial wall ; one tracheal ulcer of unknown ætiology ; giving a positive finding in 22% of cases.

We would suggest that these results demonstrate that bronchoscopic investigation is a necessary investigation in a large percentage of the cases of chronic non-tuberculous diseases of the lungs.

V. E. Negus (in reply) said that abscess due to breaking down of carcinoma was difficult to diagnose bronchoscopically, as there might be growth in the parenchyma of the lung with no carcinoma visible in the bronchus. Two such cases he had treated as lung abscess, and it was only later that carcinoma was discovered.

With regard to the coughing-up of foreign bodies, four of those cases were bronchoscoped by himself or a colleague, and the patient coughed up the foreign body before a second attempt could be made.

With reference to the cure of bronchiectasis, he congratulated Dr. Martin on his success ; he had not himself achieved it.